

Research paper
Year (Vol.), ...-, 2026

Appraisal Resources in Science Communication: Astrophysics Discourse in Academia and Media

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Article Info

Article type:

Research article

Article history:

Received: 01 Jan. 2026

Accepted: 18 May 2026

Keywords:

Appraisal Theory,
academic discourse,
evaluation,
popularized discourse,
science communication

ABSTRACT

Science communication has been investigated through a variety of theories and perspectives. However, certain fields that are targets of science popularization have not received due attention. This study, therefore, aimed to examine evaluation in the spoken academic and popularized English discourse of astrophysics. Thirteen episodes from a well-regarded documentary represented the popularized discourse in the research, while twelve academic lectures by college professors represented the academic discourse. First, the data were transcribed using Trint, and then the corpus was analyzed with UAM CorpusTool based on the categories of Appraisal Theory. The analysis revealed that the most frequent resources in both corpora were Graduation, Attitude, and Engagement, respectively. Moreover, the results of four chi-square tests revealed significant differences in the use of appraisal resources between them. The findings, which are explained by different factors such as the audience and communicative goals, have implications for science communicators in academic and popular contexts.

Cite this article: Shoja, L., Karambeigi, A., Afshar, T. (2026). "Appraisal Resources in Science Communication: Astrophysics Discourse in Academia and Media". *Journal of Linguistic Studies: Theory and Practice*, Year (Vol.), ...-.....



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Publisher: University of Kurdistan.

DOI: [10.22034/jls.2026.145290.1338](https://doi.org/10.22034/jls.2026.145290.1338)

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Introduction

Communication is a fundamental part of science and scientists make and test claims in order to build a body of knowledge (Russell, 2010). They aim to share their results with both their peers in scientific communities and with the public to reach a wider audience. Communicating scientific ideas and making them public is important for the survival and growth of the scientific enterprise (Ben Ari, 1999) as well as the development of “science literacy” (Sapp, 1995, p. 4). Science popularization texts are the main way for interested non-experts to learn about various scientific and technical issues and, thus, have a significant role in inspiring the passion for science (Stekolschik et al., 2010).

For a long time, academic discourse was seen as totally impersonal, informative, and objective, presenting representations of reality where words deal straight with facts (Farnia & Ebrahimi, 2024; Lee, 2006), unlike science popularization texts that seem to allow scientists to express personal feelings about their work (Ben-Ari, 1999). However, academic discourse is no longer considered to be entirely author-absent (Hyland, 2010).

When presenting scientific findings to both specialists and non-specialists, the same content must be conveyed in two different types of discourse (Giannoni, 2008) and to two different audiences. The intended audience is an important factor to consider when creating a discourse (Hempel & Degand, 2008). Scientists who want to share their passion for science with the public must have a certain level of knowledge to make appropriate decisions about what information to include (Hyland, 2010). It involves more than just translating technical language into non-technical language. Authors must also be able to explain complex scientific concepts in an engaging and entertaining way (Ben-Ari, 1999), using effective communication techniques (Sapp, 1995) to reach an audience that may not have specialized knowledge or familiarity with scientific jargon.

Surveys of people’s understanding of science have shown that there is a gap between the general public and scientists (Bensaude-Vincent, 2001). This highlights the need for scientists to improve their understanding of the public and to rethink the relationship between scientists and the public to better communicate science (Turney, 1996). One way for speakers or writers to effectively engage with their audience is through the use of appraisal resources.

Given the importance of discourse in science communication, comparative studies conducted on research articles and popularized articles have helped better understand these two genres’ ideologies and methods. They have investigated these genres’ differences from a variety of aspects, such as politeness strategies and lexical cohesion (Myers, 1989, 1990), schematic structures (Nwogu, 1991), visual elements (Miller, 1998), construction and negotiation of scientific knowledge (Corbett, 2006), and the use of shell nouns (Liu & Deng, 2017). Few studies have also analyzed and compared the two genres using appraisal markers (e.g., Babaii et al., 2017; O'Halloran et al., 2011; Saidi et al., 2021).

However, while extensive comparative research has investigated popularized written discourse, spoken discourse has not received due attention. Thanks to technological advances and the expansion

of the internet, which have reduced barriers to accessing scientific knowledge, scientists have explored new forms of science popularization, such as science podcasts (Birch & Weitkamp, 2010; Ye, 2021) and TED talks (Kedrowicz & Taylor, 2016; Li & Li, 2021). These sources are crucial for sharing scientific information with the general public (Hyland, 2010). Thus, this study also aimed at examining the spoken discourse through investigating the evaluative linguistic resources that exist in academic and popular science discourse using Appraisal Theory. According to Lievrouw (1990), popularized science is a representation of science for the public, and not all scientific fields and discoveries are suitable for popularization. Ren and Zhai (2014) assert that it is important to include information that is relevant to the practical needs of the public to improve scientific literacy. With these considerations about fields and knowledge suitable for popularization, the field of astrophysics was chosen for this study; not only does it have the public's attention and interest but also explores the universe, helping us better understand both the cosmos and ourselves (Keeler, 1897). The study, thus, aimed to address the following questions:

1. What evaluative resources are frequent in the spoken English popularized discourse of astrophysics?
2. What evaluative resources are frequent in the spoken English academic discourse of astrophysics?
3. Is there any significant difference between the spoken academic discourse and popularized discourse of astrophysics regarding evaluative resources?

The null hypothesis for the third research question is as follows: There is no significant difference between the spoken academic discourse and popularized discourse of astrophysics regarding evaluative resources.

Theoretical Framework

Appraisal Theory, grounded in Systemic Functional Linguistics (SFL), provides an in-depth examination of the concept of evaluation. It is a framework at the level of semantics that brings interpersonal meanings to light (Hood, 2004). According to White (2015), appraisal is an approach to inquire into how language is used to take up stances and evaluate; it explores the way language is used for handling interpersonal interactions. Martin and White (2005) describe it as a framework for understanding how people evaluate and respond to events and situations. According to this theory, our emotional reactions are not simply automatic responses to external stimuli, but are instead shaped by our subjective appraisals of those stimuli. It involves three main domains, namely Attitude, Graduation, and Engagement.

Martin and White (2005) define Attitude as a system dealing with reactions that come from our emotions and feelings, judgments, and evaluations towards phenomena and things. It consists of three subcategories which are “traditionally referred to as emotions, ethics, and aesthetics” (p. 43) and respectively allow for expressing emotions, positionings towards or against others' behaviors, and evaluation of things or phenomena. In fact, Attitude consists of three subcategories, including *affect*,

judgment, and *appreciation*. *Affect* is about “positive and negative feelings” (p. 42). The second subcategory of Attitude, *Judgment*, concerns attitudinal positioning as well as stances towards behavior, and deals with ethics; it is about the resources for evaluating behavior based on social normative guidelines. The last component of Attitude, that is, *Appreciation*, includes assessing entities, situations, natural phenomena, events, or happenings based on aesthetics and social values related to them (Martin & White, 2005).

Engagement is defined as the linguistic resources through which speakers or writers express their stance and position themselves in relation to a topic and to alternative viewpoints surrounding it. It is expressed in two ways: *Heteroglossic* utterances, which leave space for other perspectives, and *monoglossic* utterances that preclude other opinions (Martin & White, 2005).

Graduation refers to the intensity of a response and is about the resources that blur or sharpen a response with a range from mild to intense (White, 1998); it allows for softening or sharpening an individual's *appreciation* or *judgment*. Martin and White (2005, p.137) divide Graduation into two subcategories of *force* and *focus*. *Force* encompasses grading in terms of “intensity or amount” and *focus* entails grading in terms of “prototypicality and the preciseness by which category boundaries are drawn”.

Method

Design of the Study

Using a discourse analysis approach, this corpus-based study involved first identifying evaluative resources in two academic and popularized corpora, and then using both descriptive and inferential statistics to examine their frequencies and the potentially significant variable of discourse type in relation to them. This descriptive-analytic study did not involve any manipulation of the variables. It should be noted that few potential confounding variables may have influenced the design of the study. First, presenter style may have affected the use of evaluative resources, as the popularized corpus consists of a single science communicator, while the academic corpus includes lectures by three scholars. Second, differences in topic complexity across the corpora may have shaped the appraisal resources. Third, the discourse formats differ in their degree of planning. Thus, while the study focuses on discourse type as the primary variable, these factors should be considered when interpreting the findings.

Corpus

The corpus had two parts: popularized and academic. The former was chosen from a very well-known documentary called *Cosmos: A Spacetime Odyssey*. The documentary consists of 13 episodes (each 45 minutes long) comprising a total of 60,068 words. The academic corpus included 12 lectures, with a total of 65,544 words.

Cosmos: A Spacetime Odyssey is a 2014 TV series that explores the wonders of the universe and science. It is a sequel to the 1980 TV series *Cosmos: A Personal Voyage*, hosted by Carl Sagan, which was a landmark for science documentaries. The series uses some of the same features as the original *Cosmos*, but also includes updated information and advanced computer graphics to enhance the narration.

The series, which has been praised by critics and has won several awards, is hosted by Neil deGrasse Tyson, an American astrophysicist, author, planetary scientist, and science communicator.

The academic corpus included 12 lectures (i.e., five academic lectures (84–97 minutes long), two of which with three sections and the other three with two sections). Considering the difficulty of finding a reliable and suitable source for the academic part of the study, a physics graduate from Sharif University of Technology, Tehran, Iran, was consulted about finding an appropriate source, and as a result, the summer conferences of the Kavli Foundation were selected. The Kavli Foundation funds research in four fields, including astrophysics, and recognizes scientific achievements with the Kavli Prize. The Kavli Summer Program in Astrophysics is a six-week-long event that happens almost every summer. It brings together faculty members, graduate students, and local scientists. The conferences from 2017 were selected for the academic part of the study as they were accessible to us. The lecturers of the conferences were Will Farr, Deirdre Shoemaker, and Cole Miller.

The corpus, purposively selected to represent two distinct registers, allowed for comparative analysis across contexts. The celebrated documentary was chosen for its cultural impact and production quality, while the lectures were included based on expert consultation to ensure they exemplified authentic, specialized academic discourse in the field. The corpus size was considered adequate given the study's design, where analytical depth and contextual interpretation are prioritized over large-scale generalization (Baker, 2023; McEnery & Hardie, 2012). As there are no fixed guidelines for corpus size in small discourse studies, adequacy was judged in relation to research scope and feasibility. The academic corpus was also compiled to be comparable in size to the popular corpus, following practices in contrastive corpus design (Biber et al., 1998).

Procedure and Data Analysis

Since the study aimed at analyzing the spoken English discourse, The first step following the compilation of the corpus was the transcription of the spoken data. It was done using a software program called Trint. The program has high accuracy, yet the whole transcribed text was checked for any possible errors; few minor errors in the academic corpus were corrected. Then, to code the evaluation resources, the researchers used an annotation software program called UAM CorpusTool (version 6.2) that assists with coding and counting resources of Appraisal.

Rather than coding independently and calculating inter-rater reliability post hoc, to guarantee the precision of the analysis, before analyzing the whole corpus, five percent of it was analyzed by the second author and then checked by the other two researchers, who are thoroughly familiar with the analytical model as they are linguistics and applied linguistics professors who have researched different SFL topics. During this process, the coders referred back to the model and established guidelines to ensure consistent application of the framework.

The raw frequencies were then arranged for the three main domains of Appraisal Theory and their subcategories. To compare the two corpora that were of different lengths, the raw frequencies were adjusted to 100,000 words; this benchmark, which was selected considering the size of each corpus,

provides a consistent and understandable scale for comparing relative frequency patterns between the two datasets. Four chi-square tests were also conducted to examine possible significant differences in the appraisal resources between the two corpora.

Results

Evaluation in the Popularized Discourse

To answer the first question of the study, the frequencies of the resources in the popular corpus are reported in Table 1.

Table 1. Appraisal Resources in the Popularized Corpus

Appraisal resources	Total frequency	Normalized frequency
Attitude	1551	2582.07
Affect	44	73.25
Appreciation	1392	2317.37
Judgment	115	191.44
Engagement	1210	2014.38
Monogloss	834	1388.42
Heterogloss	376	625.95
Graduation	2929	4876.14
Force	2622	4365.05
Focus	307	511.08
Total count	5690	9472.59

The results show that among the three main domains, Graduation resources were the most prevalent in the corpus. Out of 5690 identified markers, 2929 of them were Graduation markers, which account for 51.47% of all the markers found in the popularized corpus. The second frequently used domain was Attitude with 1551 markers, which constitute 27.25% of the resources found. The least frequently used main domain was Engagement, comprising 21.26% of the resources' total count, with 1210 markers.

Among 5690 markers found in the popularized corpus, *force* was the most frequently used subcategory with 2622 markers, which accounts for 89.51% of the Graduation markers and 46.08% of all the markers. Some examples from the corpus are as follows:

- (1) Dark matter is completely unobservable, except for its gravitational effect, which makes visible stars and galaxies move faster.
- (2) On the other hand, if the universe had less dark matter, the expansion would continue forever, just getting slower and slower.
- (3) We call it "dark energy," but that name, like "dark matter," is merely a code word for our ignorance.

The next most frequently used resource was a subcategory of Attitude, *appreciation*, with 1392 markers that account for 89.74% of the Attitude markers and 24.46% of all the markers in the popularized corpus.

- (4) Knowing that the Earth itself is like a giant bar magnet explains one of the most beautiful sights in the sky, the aurora.
- (5) News of his invention spread quickly, and suddenly, that an assistant was the toast of London.
- (6) The Sun is a great, big ball of incandescent gas.

The next commonly used resource was *monoglossic* utterances, a subcategory of Engagement. *Monoglossic* resources in the popularized corpus account for 68.92% of the Engagement category and 14.65% of all the resources. The other subcategory of Engagement, *heteroglossic* utterances, was frequently used in the corpus with 376 markers, which account for 31.07% of the Engagement markers and 6.6% of all the markers in the popularized corpus.

- (7) Wegener concluded that there was only one logical solution to this puzzle.
- (8) Researchers found telltale traces of this iron in a thin layer below the surface of the manganese nodules.
- (9) What's more, there's evidence that Eta Carinae is being gravitationally tormented by an evil twin - another massive star in orbit around it as close as Saturn is to the Sun.

Although *force* was the most prevalent in the popularized corpus, its fellow subcategory of Graduation ranked fifth. After heteroglossic utterances with 376 markers, *focus* was the next frequently used with 307 markers, which account for 10.48% of Graduation markers and 5.39% of all the markers. Some examples are presented below.

- (10) He called this kind of stellar death a "supernova" and predicted that the dying star would shrink from about a million miles across to only ten.
- (11) One problem was the almost ceaseless warfare between the cities of Mesopotamia.
- (12) About 10,000 years ago, our ancestors all over the world took advantage of another form of climate change.
- (13) The carbon-based molecules we call proteins, the molecules of life, contain literally hundreds of thousands of atoms.
- (14) When a living cell divides in two, each one takes away with it a complete copy of the DNA.

According to White (2015), the scaling process in *focus* operates by sliding in between two ends of a continuum. One tail of the continuum is the soft tail used by hedging or vagueness (Examples 10, 11, and 12), and the other end of the continuum is the sharp tail used to show that the valeur represented is a central or typical example and that the relationship is very clear (Examples 13 and 14).

The sixth frequently used resource is a subcategory of Attitude, *judgment*, with 115 markers, which account for 7.41% of Attitude markers and 2.02% of all the markers. Here are two examples.

- (15) He was a genius of pattern recognition.
- (16) Even as a young Dominican monk in Naples, he was a misfit.

Like the sixth frequently used resource, the least frequently used resource is also one of the three subcategories of Attitude. Of 5690 markers found in the popularized corpus, *affect*'s share was only 44, which equals 2.8% of Attitude markers and 0.77% of all the markers. Some instances are as follows:

- (17) I fear I'm losing my mind.
- (18) And there's so much more we like to do for you.
- (19) And primitive demonstrations of electricity never failed as a crowd pleaser.

Evaluation in the Academic Discourse

The second research question was about appraisal resources in the academic corpus. The results of the analysis are reported in Table 2.

Table 2. Appraisal Resources in the Academic Corpus

Appraisal resources	Total frequency	Normalized frequency
Attitude	1519	2317.52
Affect	6	9.15
Appreciation	1504	2294.64
Judgment	9	13.73
Engagement	786	1199.19
Monogloss	314	479.06
Heterogloss	472	720.12
Graduation	2245	3425.18
Force	1981	3022.39
Focus	264	402.78
Total count	4550	6941.90

The results reveal that among the three main domains, Graduation resources were the most prevalent in the lectures. Out of 4550 identified markers, 2245 of them were Graduation markers, which account for 49.34% of the markers in the academic corpus. The second frequently used main domain was Attitude with 1519 markers, which is 33.38% of the resources. The least frequently used main domain was Engagement with 786 markers, accounting for 17.27% of the total resources.

Among 4550 markers in the academic corpus, *force* was the most prevalent category with 1981 markers, which is 88.24% of the Graduation markers and 43.53% of all the markers. Four examples are listed below.

- (20) Many, many, many, many, many, many times I integrate out the data part distributions always integrate to one.
- (21) But this is such a popular story that it's what we're going to use. Your time equals zero.
- (22) Clearly, they're not part of the linear relation so far.
- (23) You could push it to ten the minus five and explain some of this stuff. But even that's quite high.

The second most commonly used resource was a subcategory of Attitude, *appreciation*, with 1504 markers accounting for 99.01% of the Attitude markers and 33.05% of all the markers in the academic corpus.

- (24) So, we need a way to summarize this. And the way that is commonly chosen, though not exclusively, is to draw samples from this distribution.
- (25) We measure two quantities X and Y repeatedly, and we believe that there's some underlying Y true that follows a linear relation with respect to X.
- (26) Okay, so in a minute, we'll learn the right way to deal with the crazy data, but we're going to ignore it for the moment.
- (27) We could fit all the data, including the crappy data, and ask what happens and then what to do about it.

Heterogloss emerged as the third most frequently used resource. *Heteroglossic* utterances account for 60.05% of the Engagement markers and 10.37% of all the resources in the lectures with 472 markers.

Examples from the corpus are as follows:

- (28) And there's a theorem about joint distributions that says you can write them in either of two D compositions.
- (29) People have also talked about heating processes that can cause density asymmetries that
- (30) People call these error bars. I'm not an experimentalist, so I really shouldn't speak.
- (31) Plus, B plus some random scatter that picks Y up and down. And people often call this intrinsic scatter,

The fourth most frequently occurring resource was the other subcategory of Engagement, *monogloss*. With 314 markers in the lectures, *monoglossic* utterances constitute 39.94% of the Engagement markers and 6.9% of all the markers in the academic corpus.

The fifth frequently used appraisal resource in the academic corpus was *focus*. Considering that Graduation was the most prevalent evaluative resource in the academic corpus with 2245 markers, *focus* with 264 markers only accounted for 11.75% of the Graduation markers and 5.8% of all the resources found. Some examples are as follows:

- (32) Otherwise, you're doing some sort of weird melding of the electromagnetism gravitation.
- (33) This is a property of this type of radiation that has intrigued a lot of people for some time.
- (34) whereas the so-called soft gamma repeaters, where you have a burst of some sort and in fact people have seen
- (35) Sometimes this is the longest step it takes, you know, 30 seconds or something.
- (36) I'm going to create a condition where I get rid of most of it in a clever coordinate choice, and I'm going to let it to some extent sit there.

Judgement, the sixth frequently used resource, had only 9 markers in the academic corpus. Although Attitude markers were the second most commonly used, *judgment* markers were very rare. They accounted for only 0.59% of the Attitude markers and 0.19% of all the markers in the lectures. Here are four of the cases found in the lectures.

- (37) David Hogg is a fantastic data analyst and has had a number of fantastic students.
- (38) In 2010, he got together with two of his most amazing students and wrote the Bible.

- (39) That means I'm agnostic about the slope from minus infinity to plus infinity.
- (40) You know, this great scientist made a movie diagram frame that's supposed to have a positive value.

The least prevalent resource was also a subcategory of Attitude, *affect*. Only 6 *affect* markers were found in the lectures, which is 0.39% of Attitude markers and 0.13% of all the markers in the lectures.

- (41) We all go home happy without even realizing, well, maybe one could have come up with that really perfectly reasonable model.
- (42) If this had come out the other way, we'd worry our fit has gone off the rails.
- (43) I hope you have enjoyed doing various things, including some of you destroying older on.

A Comparison of Appraisal Resources in the Two Corpora

To answer the third research question, that is, to check for any significant differences in the use of appraisal resources between the academic and the popular corpus, four chi-square tests were run. First, the comparison is done among the three main categories and then with regard to their subcategories. The results for the former are presented in Table 3.

Table 3. Chi-Square Test on Differences Between the Academic and Popularized Discourses Regarding Evaluative Resources

	Value	df	Asymptotic significance
Pearson chi-square	86.67	2	<0.001
Likelihood ratio	86.65	2	<0.001
Linear-by-linear association	36.00	1	<0.001
N of valid cases	16414		

As the obtained significance value (.001) is smaller than $p = 0.05$, the related null hypothesis is rejected and we conclude that there is a significant difference in the use of evaluative resources between the spoken academic and popular discourse of astrophysics. Since this significant difference is revealed, the subcategories are analyzed too. Regarding the subcategories of Attitude and Engagement, the results of two chi-square tests reveal that there are significant differences in the use of both Attitude and Engagement resources between the spoken academic and popular discourse (Table 4).

Table 4. Chi-Square Tests on Differences Between the Academic and Popularized Discourses Regarding Attitude and

	Engagement		
	Value	df	Asymptotic significance
Attitude resources			
Pearson chi-square	189.30	2	<0.001
Likelihood ratio	224.92	2	<0.001
Linear-by-linear association	39.97	1	<0.001
N of valid cases	4899		
Engagement resources			
Pearson chi-square	259.07	1	<0.001
Likelihood ratio	259.52	1	<0.001
Linear-by-linear association	258.99	1	<0.001
N of valid cases	3213		

Finally, Table 5 presents the results of a chi-square test for differences between the two corpora with regard to the Graduation resources.

Table 5. Chi-Square Test on Differences Between the Academic and Popularized Discourses Regarding Graduation

	Resources		
	Value	df	Asymptotic significance
Pearson chi-square	3.39	1	0.065
Likelihood ratio	3.37	1	0.065
Linear-by-linear association	3.39	1	0.065
N of valid cases	8301		

Since the significance level is 0.06 (> 0.05), we cannot conclude that there is a significant difference between the two corpora regarding the use of Graduation resources. However, since the significance level is just above the cut-off of 0.05, there may be evidence for some effect.

Discussion

Appraisal in Science Popularization

The findings of the study revealed the occurrence patterns of appraisal resources in both spoken academic and popular discourse of astrophysics, as well as significant differences between them. In the popular discourse, a high preference for using Graduation resources was observed, which may mean a high tendency toward intensification, down-toning, and sharpening or blurring the focus of utterances. Among Graduation subcategories, *force* was the most frequently used resource, accounting for almost half of all the resources in the popularized corpus. This considerably high frequency, which is nearly twice that of the next most common resource, can be explained by two factors: (1) the way the speaker thinks and the value the lectures want to achieve; and (2) the function of the evaluative resource. This volume of using *force* indicates that the tendency toward precision or sharpness of the values is very important for the speaker. By using various words and structures for scaling his opinions or feelings, the speaker tried to

get closer and share new discoveries with the audience by bringing back the voice of the scientist, which can be missing in professional science communication (Hyland, 2010). In popular science communication, the speakers want to show scientific results and make the audience agree with their worth (Lievrouw, 1990) rather than to prove their truth (Miller, 1998). Thus, the preciseness of the boundaries may not be critical (White, 1998). The most frequent use of *force* resources may plausibly reflect the speaker's need to amplify evaluations and highlight key meanings, particularly in the explanatory and audience-oriented discourse, where intensification functions to enhance clarity, emphasis, and audience engagement (Martin & White, 2005). In a nutshell, the predominance of Graduation, especially *force* markers reflects the communicative goals of *audience engagement and comprehension*. In science communication research, intensification is recognized as a rhetorical strategy that helps structure explanations and signal significance for non-expert audiences, enhancing *processing fluency* and interest (Bucchi & Trench, 2021).

The next prevalent resource was Attitude, with *appreciation* markers accounting for almost 90% of its resources. One possible reason why Attitude markers were more common than Engagement markers in the popular discourse is that they let language users show their feelings and opinions instead of just stating facts (Abdollahzade, 2011). They can make science engaging and interesting for the audience and convince them to accept and assimilate both historical and new scientific knowledge about the astrophysical movements and events (Giannoni, 2008; Miller, 1998). Creating a lively and exciting discourse that shows both sides of the debate in scientific research (Bowler, 2009), Attitude markers also enable language users to share their emotions about the work and discoveries in the field (Ben-Ari, 1999). The main goal is to appeal to the audience's emotional response rather than their reasoning (Miller, 1998). This aligns with audience-centered science communication models that show the importance of fostering engagement and curiosity, which are crucial for retention and motivation (Besley & Dudo, 2022).

Engagement resources were the least common type of appraisal resources in the popularized discourse. Engagement shows how much the writer or speaker is confident, involved, or aligned with the topic and audience (Oteiza, 2017). The popular science communicator employed more *monoglossic* resources than *heteroglossic* ones. It seems that he preferred to present a more informal account of scientific findings in the field of astrophysics. This is similar to the findings of other studies that showed the helpful use of informal tools, such as humor and comedy in making the scientific communication and the science popularization easier (Pinto et al., 2015; Riesch, 2014). This way of communicating knowledge helps the communicator preserve his face as a direct and confident science communicator (White, 2015). Although Shaw and Vassileva (2009) concluded from their study that the exceeding number of *monoglossic* resources may be because the discourse comes from a local context and has limited audience, the worldwide praised popularized corpus of the study showed that there is not necessarily a relationship between the context, number of audiences, and the use of Engagement resources. This is also in contrast with Parkinson and Adendorff (2004)'s claim that popular science communicators tend to be more cautious about what they are saying, so they use more *heteroglosses* in order to prove themselves as "open

to challenge” (p. 394). In fact, it seems that the popular science communicator uses *monologlosses* in order to make the audience consider him as one of them, because in most lay conversations, references are rare (Fahnestock, 1998). Finally, the high frequency of *monoglossic* markers may be attributable to the documentary format, where the script is not entirely spontaneously produced.

Appraisal in Academic Discourse

About the academic corpus of the study, it was found that the most commonly used markers by the lecturers were the Graduation resources, with *force* being the most prevalent subcategory. While the use of *appreciation* markers is considered to be the most effective way of attracting attention in academic discourse (Hyland & Tse, 2005), the lecturers of the academic corpus in the current study did not follow it. Instead, they relied most heavily on intensification markers. This may reflect the academic context in which university instructors address learners within their discipline. It is possible that this different way of using language has come from the needs of the audience. The use of Graduation resources facilitates audience engagement by emphasizing the relevance and worth of the assertions (Lievrouw, 1990). The lecturers presented the information in a more discreet and persuasive way rather than claiming absolute truths (Varttala, 1999; White, 2015). This might indicate that they were not hesitant about switching between academic standards and popularization patterns. They also may prefer delivering information with emphasizing the “prototypicality” or “preciseness” (Martin & White, 2005, p. 137). They can show *epistemic precision and disciplinary alignment*. In fact, research on spoken academic discourse emphasizes how speakers use intensification to structure argumentation, clarify inferential strength, and signal propositional weight (Mauranen, 2002).

This analysis does not align with Hyland and Tse’s (2005) claim that scientists tend to follow academic community norms such as avoiding overgeneralization and seeing their results as some possible phenomena. A potential explanation for this discrepancy is that the prior study dealt with written discourse, in contrast to the spoken discourse examined here. Spoken and written discourse are two distinct ways of communicating that have different features and purposes. Written discourse has more nominalization and lexical density, while spoken discourse has more redundancy, repetition, and hesitation (Fairclough, 2013); according to White (2015), repetitions are one way of scaling meanings to high or low intensities, which means using *force* resources.

Following Graduation resources, Attitude markers were the second common. The lecturers embedded their emotions in the texts and demonstrated a high preference to use Attitude resources (Martin & White, 2005). Within them, *appreciation* markers comprised nearly the entire set, representing 99% of them. By using them, the lecturers give value to their utterances and assess entities, processes, and products (White, 1998). In fact, Attitude is dominated by *appreciation* in academic discourse, because specialists evaluate phenomena rather than express feelings; academic speakers strategically use positive evaluation to highlight relevance without violating norms of objectivity (Flowerdew, 2002).

Academic discourse has long been regarded as an objective description of truth (Penrose & Katz, 1998, cited in Zhang, 2015), but academic communicators inevitably aim both to inform and persuade

readers of the truthfulness of their claims (Hyland & Tse, 2005). Consistent with those studies that demonstrated the interpersonal use of resources in academic discourse (e.g., Zhang, 2015), this study verified that Attitude resources, particularly *appreciation* resources were probably used to create persuasion among the academic community (Hyland, 2008). The fact that *affect* and *judgment* subcategories were hardly used in the academic discourse may suggest that scientists do not want to give a negative judgment of their own or others' ideas to influence the target audience. However, they seem to use the most neutral subcategory of Attitude resources, *appreciation* resources, to evaluate phenomena.

Engagement resources were the least prevalent category of appraisal in the academic corpus. The lecturers used more *heteroglossic* resources that consider the existence of multiple viewpoints than *monoglossic* ones (White, 1998). Many of the resources found in the academic corpus fell under one of the most common forms of *heteroglossic* utterances, i.e., using modals such as *maybe*. Other resources used by the lecturers included using others' voices or findings to support their arguments about their new scientific findings and communicate their intended messages (Gallardo, 2005) to achieve unity with the community they belong to (Abdollahzade, 2011; Parkinson & Adendorff, 2004).

Academic Discourse versus Popularized Discourse

The results of chi-square tests revealed statistically significant differences between the two genres of spoken discourse with regard to the main categories of appraisal, including Attitude, Engagement, and Graduation, as well as the subcategories of Engagement and Attitude. Although the results were not significant for the Graduation subcategories, evidence for an effect was observed. The frequency of the Graduation resources demonstrated a strong preference of science communicators of both genres for them. They enable speakers to adjust (increase or decrease) how much their utterances affect, influence, or express their feelings, and also allow them to adjust (make vague or clear) how they define words. The scaling or adjusting that Graduation does can be done explicitly by using specific lexical items, or implicitly by choosing among different appraisal values that have different degrees of intensity (White, 2015). As Russel (2010) maintains, there has been a shift from understanding to engaging in the ways of science communication.

The number of *force* markers used by the popular science communicator was about 20% more than the number of Attitude markers used by the lecturers. This can show the popular science communicator's goal to be an eye-catcher for the lay audience that has an abundant supply of science programs to choose from. The analysis of popular science corpus shows that scientists are trying to engage the audience (Giannoni, 2008) and to reach a broader range of audiences (Lievrouw, 1990) by making their findings popularized and more accessible to the public. According to Miller (1998), the popular science communicators start from the public's interest and their main goal is to deliver an evaluative way of recent scientific discoveries they try to communicate (Fahnestock, 1998).

Similarly, the abundant use of Attitude resources by academic lecturers (even more than the science communicator of popularized discourse) is a way of achieving persuasion. As Zhang (2015) states, it is because of the different purposes of academic and popular science discourse that they use resources in

different ways and frequencies. Academic science communicators tend to use certain appraisal categories to convince their audience to accept their ideas, but popular science discourse uses these resources more widely to inform and entertain the public and to affect their frame of mind (Bowler, 2009; Sapp, 1995).

Furthermore, the abundant use of Attitude resources by the lecturers of the academic corpus questions the long-held belief that the academic way of communicating science is completely impersonal and objective (Hyland & Tse, 2005). It also questions the belief that academic science communicators find the use of evaluative resources hard, and, thus, they tend to stay in and refer to the community they are in.

Conclusion

This study sheds light on the features of academic and popularized spoken discourse concerning appraisal resources. It posits implications for those involved in disseminating science in both the public and academic arenas. Regarding the former, the findings can contribute to the literature on media discourse as well as decision-making processes related to science popularization in media through the utilization of appraisal resources. Effective popularization requires adherence to media conventions rather than the established norms of scientific communities, and evaluative resources can be examined in terms of those conventions (Russell, 2010). When addressing general audiences, science communicators can enhance clarity through explicit explanations, contextualization, and structured emphasis, while avoiding oversimplification or exaggerated claims. At the same time, maintaining transparency about uncertainty and complexity can preserve credibility. However, for academic contexts, greater precision and restraint in evaluative language remain important. Overall, effective communication requires genre-sensitive choices that make knowledge understandable and engaging without compromising accuracy, nuance, or disciplinary integrity.

This study also suggests implications for EAP pedagogy where the primary goal is to equip learners with essential knowledge and skills for success in academic communities. Discursive features of science communication can be considered in course design and materials development. This may involve having learners compare academic and popular discourse so that they can comprehend the key features of the former. Besides, the study shows the potential of materials other than commercially produced textbooks for pedagogical purposes (Iranmehr, 2024).

Although this research can contribute to the literature on appraisal resources in discourse, considering its relatively small corpus and the fact that despite the careful corpus design, the two corpora differed in presenter identity, degree of scripting, and communication setting, the findings should be interpreted with caution. Future studies, thus, should aim for a larger sample to enhance generalizability. They could also control for presenter style, topic uniformity, and genre format to isolate the effect of discourse type more precisely. Other spoken popularized and academic genres in other disciplines can be examined comparatively to examine the role of language mode in the use of appraisal resources deeply. Last but not least, multimodal analyses of spoken discourse can complement the findings of text-oriented studies like the present one.

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