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Science Dissemination in Instagram *reels*: A multimodal overview

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Abstract: In recent years, social media have become an essential part of everyday life in educational contexts, especially considering the gradual expansion of academic dissemination in social networks (Cooper, 2014). Consequently, concepts such as content recontextualization and engagement have become essential to attract and maintain an audience for the dissemination of science in social media (Bernad-Mechó & Valeiras-Jurado, 2023; Bezemer & Kress, 2008; Khan, 2017). A multimodal perspective for the analysis of social media's polymathic nature seems to be necessary, as the combination of semiotic modes such as speakers' gestures or the process of postproduction contribute to communicating information and engaging the audience (Welbourne & Grant, 2016). Science dissemination videos have, in fact, been widely analyzed from a multimodal point of view (Bernad-Mechó & Valeiras-Jurado, 2023). Nevertheless, few studies have investigated science dissemination Instagram reels from a multimodal perspective. Accordingly, the aim of this paper is twofold: first, to examine the modal density of science dissemination Instagram reels attending to their embodied and filmic modal ensembles (Valeiras-Jurado & Bernad-Mechó, 2022); and second, to discern the most salient engagement strategies used in this potential digital genre. To achieve this objective, seven videos retrieved from popular Instagram scientific content creators have been selected and studied using the software GRAPE-MARS (Ruiz-Madrid et al., 2023). The findings of this research illustrate that science dissemination short videos on Instagram share a set of modes, such as the use of deictic gestures and subtitles, that aid the audience to comprehend specialized content. In addition, the results also revealed that reels' modal density contributes to creating engagement strategies to attract the audience's attention and emphasize key elements.
Keywords: Science dissemination videos; multimodality; Instagram *reels*; engagement strategies.

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1. Introduction

1.1. Science dissemination

The need to convey and transmit complex information to others is intrinsic to human beings. Regardless of the purpose (either academic or extracurricular), multiple variables play a role when constructing an explanatory discourse (Graham, 2000). One of the most determinant variables in this process is the target of the message, that is, the audience to which discourse is directed. The reason for this is that a discourse tends to be adapted depending on the characteristics of its target (Buchanan & Dawson, 2007). Scotto di Carlo (2014) highlights the radical change in how academic information has been disseminated since the appearance of new digital genres, which create an atmosphere of closeness between research commentators and viewers. In this aspect, academic institutions are not the only entities in charge of disseminating science as new media afford novel ways to communicate research.

Science dissemination is a process in which scientific data and/or research studies are adapted to be comprehensible and accessible to an audience that may not be familiarized with the topic discussed. This

process is essential for the prosperity of science itself, as scientific communities need to communicate their ideas and findings to spread awareness of their research and acquire funding for their investigations (Gill et al., 2015). In addition, these messages need to be adapted to a wider audience, as scientific information may feature complex procedures and terminology for which non-specialized users may need effective guidance and clarifications. According to Bezemer and Kress (2008), this process is known as *recontextualization*, and it involves the selection and arrangement of the content, its foregrounding, and the reconstruction of social interrelationships between the speaker and the onlookers. An essential aspect of recontextualization is its multimodal nature, as it considers and adapts all the different modes in which information is conveyed. In the case of science dissemination, there is a need to recontextualize scientific data to new semiotic modes to allow people unfamiliar with a topic to understand a particular sphere of knowledge (Valeiras-Jurado & Bernad-Mechó, 2022). As Luzón (2019) points out, online science videos are rich in recontextualization strategies that enable unspecialized viewers to comprehend specific scientific terms.

As for the use of social media in science dissemination, Osterrieder (2013) highlights their benefits for researchers as they allow "scientists to disseminate research findings quickly and effectively as well as raise their own profile, of their research groups or institution. [...] More and more funding agencies, e.g. the European Commission, require open access publications plus outreach activities" (p. 3-4). For that reason, it may be argued that the more effective science dissemination is, the better outlook researchers can expect for future advances in their inquiries.

A dominant presence of science promulgation can be perceived in English Medium Instruction (EMI) contexts, where these dissemination resources are used to teach science-related subjects in English. Through the use of new forms of science dissemination, such as online videos, EMI classrooms can access realistic approaches to the topics discussed and taught (Macaro et al., 2018). In addition, research has proved that English for Specific Purposes (ESP) environments can also benefit from science dissemination through documentaries, presentation films, animation videos, and explanatory narrative films (Girón-García & Fortanet-Gómez, 2023; Muñoz Morcillo et al., 2016). In these two contexts, advances in Information and Communication Technologies (ICTs) during recent years have been a crucial contributor to the dramatic expansion of dissemination possibilities. In fact, researchers such as Meredith et al. (2011) comment on the issue of the vast range of options for dissemination on the table and describe how previous genres have evolved and adapted to new digitized horizons.

An example of an audiovisual genre that promotes science is TED Talk videos, which have been compared to sales pitches by Ludewig (2017) for their engaging characteristics and ability to transmit specialized information to a not necessarily expert audience. In addition, Masson (2014) underlines that TED Talks are recorded live presentations in which the event assistants can directly interact with the presenter and add helpful information to the video through impromptu questions and remarks. Also related to online science dissemination, the Three Minute Thesis presentations (3MT) genre has become an option for researchers to communicate their investigations. These short competitive presentations consist of three-minute presentations by doctoral students who explain their inquiries with a single slide in 180 seconds. According to Hyland and Zou (2022), information must be synthesized to the limit of 3 minutes in this digital genre, thus enabling the spectators to learn about many studies rapidly and practically. Carter-Thomas and Rowley-Jolivet (2020) focus on 3MT's strategies to convey scientific information to the audience and engage their interest through personalization, interaction, and humor. Their results show that this genre is characterized by a generic structure with a register and set of communicative traits of its own.

Even though the aforementioned formats have served as datasets for many studies, there is a platform of audiovisual media that outshines its counterparts for its evident popularity and possibilities: YouTube. The need to engage the audience is a priority for YouTube content creators, as they seek to make their videos appealing and attractive to retain their viewers' attention. Biddinika et al. (2019) suggest that YouTube has a valuable, shareable nature and significant educational potential. In fact, Khan comments that "engagement [in YouTube] is manifested through actions such as liking, disliking, commenting, sharing and uploading videos" (2017, p. 237). Engagement strategies on YouTube have been widely researched, as content creators tend to combine semiotic modes to attract the interest of possible viewers (Vedula et al., 2017).

1.2. Engagement in social networks

Social media have grown to become an essential part of the socio-cultural, educational, and technological framework of human beings. They serve as daily communicative tools, not only for people who seek to upload content to the internet, but also for users to be informed about topics of their choice on a worldwide scope. Over the years, social media use has grown to become a topic of interest among researchers, who explore their compelling and effective characteristics to transmit information directed toward different target niches (Hallinan et al., 2023). As pointed out by Parry et al., social media use "refers to a nebulous and ever-expanding set of actions that are difficult to accurately measure" (2022, p.1). Hence, it could be claimed that the reasons for its exponential growth are an abiding matter of debate. An intrinsic concept that seems to shed some light on the success of social media in current society is that of 'engagement' (Barnes et al., 2019). According to Khan, the concept of engagement in digital genres could be defined as "an individual's interaction with media. [Engagement comprises] behavioral aspects or click-based interactions (participation) as well as simple content viewing and reading (consumption)" (2017, p. 237). Welbourne and Grant (2016) underscore user-generated content and consistency as supporting factors for YouTube's popularity and engagement among science dissemination content creators. In this way, it could be said that social media

content creators rely on and reproduce certain patterns in their posts to reach possible new audiences and retain the attention of their viewers. This process is often conducted through a bonding experience between creators and followers, which is a determinant characteristic of the functioning of social networks (Schreiner et al., 2021).

Several studies have highlighted a set of engagement strategies used by content creators to generate a shared atmosphere and connect with their public. Amongst that list, discursive strategies may be highlighted, such as the use of inclusive pronouns to involve the spectators in the situations described by the communicators (Cress, 2022). Another resource is the frequent use of both rhetorical and direct questions (Wilkins et al., 2019). According to Xia and Hafner, "[content creators] are supposed to be conscious of the existence of the audience or readers; furthermore, they are expected to bond with the audience in some way" (2021, p. 35). Thus, it may be affirmed that rhetorical questions are used to entice the audience, whereas direct questions are used to create debate and feedback amongst viewers and between creators and viewers. The modulation of the speakers' tone to appear more conversational and friendly is also a recurrent characteristic found in audiovisual content in social networks (Sung & Kim, 2021). For example, it is proper to use a higher pitch voice, colloquialisms, and simplified vocabulary. In addition, research has remarked on the recurrent combination of image and text in social media's audiovisual material as an effective engagement strategy for social media users (Li & Xie, 2020). Bernad-Mechó and Valeiras-Jurado (2023) draw a 5-item engagement strategies taxonomy from Luzón's (2019) and Carter-Thomas and Rowley-Jolivet's (2020) previous research. The parameters of this taxonomy are applied to a study of engagement in YouTube videos, a widely inquired audiovisual-based social media network. These variables consider emphasis (when the focus is placed on a particular element of the video), attention-getting (an element of the video attracts the attention of the viewers), dialogic involvement (the inclusion of the audience in the discourse), humor (jokes and irony), and control of responses (anticipating information featured in the video so that the audience is attentive of what may happen next). These authors note down that the five engagement strategies of this taxonomy are realized multimodally, i.e. through the combination of multiple semiotic resources.

According to Lu (2023), approximately 122 million YouTube users consume content on this social network daily as of 2022, which evidences it as being one of the most used social media platforms in current days. Audience attraction and retention are relevant concepts to underline in YouTube's nature, as it has become a platform destined not only to entertain but also to monetize the content created by influencers (Wang & Chan-Olmsted, 2020). Therefore, a special focus is placed by companies on the ability of their YouTube content creator partners to engage with their viewers and possible customers. A study by Munaro et al. (2021) analyses the features of video content in this platform and the effect they have on digital client engagement. These authors foreground the use of personal pronouns as a helpful linguistic tool to direct the onlookers' focus toward a particular idea, as well as the use of stories and narrative devices to prolong the audience's attention span. Therefore, it could be claimed that YouTube's widespread use and multimodal essence have caused the sphere of science dissemination to open its horizons to novel audiences through communication in an audiovisual fashion (Welbourne & Grant, 2016), and that engagement in digital media is multimodal in nature (Bernad-Mechó & Valeiras-Jurado, 2023).

The multimodal perspective adopted by several researchers on the characteristics of YouTube's information-conveying process continues to expand as new functions and trends emerge in the platform (Riyandi, 2022). Nevertheless, although numerous studies have argued the multimodal component and engagement strategies of YouTube videos, few investigations have considered the potential of audiovisual media in other social networks, such as Instagram (Sarangapani & Hashim, 2022). The implementation of Instagram *reels*, a short vertical video configuration inside this platform, has opened the door to further study of a possible new digital genre in which science dissemination has found a place. *Reels* are characterized for having a generally heavy video-editing process, often aimed to overcharge the audiovisual material with more information, such as supporting text, images, cuts, transitions, and sound effects, amongst other traits. The official definition of *reels* according to Instagram is "a new way to create and discover short, entertaining videos on Instagram" (2020). This section within the platform is dedicated to creating and sharing short vertical videos about varied topics (Menon, 2022), and science dissemination has found a niche in this potential digital genre. The freshness and creativity of this emerging digital genre raise the question of whether the findings of previous studies on engagement and multimodality in other social media's science communication videos could be applied to *reels* and the differences this disseminating tool presents as opposed to its antecessors.

1.3. Multimodal Discourse Analysis

As argued above, the scoping analysis of digital genres has expanded gradually during recent decades as new communication forms have emerged (Boulianne & Theocharis, 2020). Alongside the broadening of this scope, novel perspectives have been adopted to shed light on unexplored aspects of message transmission, amongst which multimodality should be highlighted. This field of study is grounded on the conjecture that language is intrinsically multimodal, which means that content is conveyed through the simultaneity of modes (Kress & van Leeuwen, 1996). A frequent tendency towards considering language as the primary dataset to unveil the inquisitiveness of discourse analysis can be noted in previous studies (Dunmire, 2012). Nonetheless, multimodality paves the way to further research and accuracy in the inquiry of communicative acts and methods, as multiple-meaning transmitters (or modes) are contemplated (Silseth & Gilje, 2019).

Kress defines the concept of *mode* as "a socially shaped and culturally given semiotic resource for making meaning" (2009, p. 79). The relevance of mode combination has been investigated in the digital environment, and moving image, speech, writing, layout, gestures, and/or proxemics have been suggested to account for samples of modes occurring synchronously in digital contexts (García et al., 2016).

The relevance of multimodality's role has been discussed during recent years (Deppermann, 2013). Jewitt (2014) distinguishes three multimodal approaches: Multimodal Social Semiotics (MSS), which has its focus on social sign-makers, Multimodal Discourse Analysis (MDA), which revolves around the combination of semiotic modes, and Multimodal Interaction Analysis (MIA), which places particular emphasis on the interaction between participants. This taxonomy has been applied to different contexts and case studies, such as academic settings (Bernad-Mechó, 2021). As this study will follow an MDA to obtain results, some related concepts need to be discussed. One of them is that of *multimodal ensemble*, which Kress (2009) describes as the combination of modes for meaning-deliverance purposes. These combinations can be arranged in a compatible way, a phenomenon known as *modal coherence*. Valeiras-Jurado explains this term as the event in which "the modes are being used in a consistent way and do not contradict each other" (2019, p. 95). In addition, the concept of *modal density* also needs to be considered, which Norris (2004) coined to refer to the frequency or intensity of the modes featured in a meaning-conveying process. In Bernad-Mechó (2022), a slightly different notion of modal density is taken into account, and it is seen as the amount of modes in a single instance; the more modes co-occurring in an instance, the more dense a given instance is.

Due to its elaborate and polymathic nature, numerous authors have decided to include a multimodal perspective in their investigations in hopes of broadening the scope of their studies and discussing possible new findings. A sphere of knowledge in which multimodality has been applied is education, as semiotic mode convergence has proved to foster students' interest in the contents addressed in the classroom (Sumer et al., 2021). Likewise, multimodal ensembles are also present in a variety of daily contexts such as social media use. The influence of mode combinations in social media platforms has been determined to affect users' feelings, decision-making abilities, and information-retention capacities (Chandrasekaran et al., 2021). Social media addiction has also been a widely discussed topic as new communication tools continue to emerge, and studies have discussed media engagement to be essentially multimodal (Stappen et al., 2020).

The multimodal approach to engagement in social media is a noticeable feature in the field of science dissemination. Content creators who base their social media profiles on the promulgation of scientific data are becoming increasingly popular on different platforms, and an example of this can be appreciated in the numerous studies conducted on MDA of science dissemination videos on YouTube (Xia & Hafner, 2021). Valeiras-Jurado and Bernad-Mechó (2022), for instance, explores semiotic mode combinations in YouTube science dissemination videos considering embodied and filmic frameworks, highlighting the strong relevance of filmic modes in digital genres. Other platforms in which science communication has also been investigated include Facebook (Rauchfleisch et al., 2023), Twitter (Ladeiras-Lopes et al., 2020), and Tik Tok (Hayes et al., 2020). Even though broad research has been conducted on different platforms regarding science promulgation in audiovisual form, little inquiry has been done on the popular Instagram *reels*.

In the absence of further research on the engaging and multimodal nature of Instagram *reels* as promising science dissemination tools, the aim of this study is twofold. First, to discern the most salient embodied and filmic modes featured in science communication Instagram *reels*, and second, to analyze engagement achievement in these kinds of videos. The following research questions have been proposed to orientate this study:

> (RQ1): What is the modal density of embodied and filmic modes in science dissemination Instagram *reels*?
> (RQ2): How is engagement conveyed in science dissemination Instagram *reels* from a multimodal perspective?

2. Methodology

2.1. The Dataset

The dataset of this study comprises seven Instagram *reels*, each featuring a presenter explaining a science-related topic. These *reels* were sourced from various popular science dissemination Instagram accounts. Table 1 presents an overview of the basic characteristics of the dataset compiled at the time of writing. The selection of these videos was guided by two primary criteria. Firstly, the Instagram accounts chosen for video retrieval were required to focus on science dissemination and possess a significant follower count on Instagram, with the selected accounts averaging 342,000 followers. Moreover, these accounts were expected to regularly upload reels, ensuring the dataset's relevance and comprehensive representation of current science communication trends. These numerical considerations were contemplated in hopes of adding a valuable updated and consolidated depth to the dataset of this analysis. Secondly, the thematic diversity of the videos was paramount. It was crucial that the subjects covered by the reels not only pertained to science but also spanned a broad array of disciplines. As indicated in the "Field" section of Table 1, the selected reels encompass topics across medicine, astrometry, chemistry, physics, biology, astrogeology, and neuroscience. This strategic selection aimed to encapsulate as broad a spectrum of scientific inquiry as possible within the study's scope.

Table 1. Basic dataset characteristics.

Code	Content creator	Username in IG	No of IG followers	Duration (s)	No of words	Field
V1	Kate Bacon	@kbacon.irl	433k	25	92	Medicine
V2	Astro Alexandra	@astro.alexandra	254k	41	157	Astrometry
V3	Hank Green	@hankgreen	1.3M	51	147	Chemistry
V4	The Physics Girl	@thephysicsgirl	175k	18	45	Physics
V5	Alex Dainis	@alex.dainis	14.7k	52	218	Biology
V6	The Galactic Gal	@thegalacticgal	101k	49	162	Astrogeology
V7	Doctor Brein	@doctor.brein	118k	69	265	Neuroscience

2.2. The Analysis

To conduct this research, the seven scientific dissemination Instagram *reels* selected were multimodally analyzed using the software *GRAPE-MARS (Multimodal Annotation Research Software)* (Ruiz-Madrid, et al., 2023). This innovative tool enables the manual annotation of the various communicative modes involved in the videos and obtain quantitative results regarding the use of semiotic resources to convey meaning.

The three categories of mode annotation were embodied modes, filmic modes, and engagement strategies. The taxonomies followed to analyze the embodied and filmic frameworks were drawn upon the study conducted by Valeiras-Jurado & Bernad-Mechó (2022) (see Table 2). Embodied modes encompass communicative resources utilized by the speakers featured in the videos, which were: spoken language and pauses, prominence, the gestures used by the communicator (according to McNeill's classification of gestures (1992): iconic, metaphoric, deictic, or beats), the directionality of the speaker's gaze (towards various focal points such as the floor, their background, the camera, the cell phone screen, or their side), proxemics relative to the camera (either standing or sitting), head movements (including tilts, shakes, nods, or glances away), and facial expressions (such as eyebrow raises, frowns, and smiles).

Filmic modes examined the post-production elements of the *reels*, including shot types (ranging from close-ups to full shots), camera dynamics (approaching or moving aside), video backgrounds (incorporating domestic settings, green screen usage, and animations), video editing techniques (cuts), musical accompaniments (categorized by mood such as mysterious, cheerful, or calm), visual prompts (images, text, movement or use of videos), sound and visual effects, and the use of subtitles. This comprehensive approach aimed to uncover the nuanced ways in which scientific knowledge is mediated through Instagram *reels*, highlighting the interplay of semiotic resources in engaging and informing viewers.

Table 2. Embodied and filmic framework variables. Adapted from Valeiras-Jurado and Bernad-Mechó (2022, p. 7).

Embodied		Filmic	
Spoken language	Spoken language	Type of shot	Close-up
	Pauses		Medium close-up
Prominence	-		Medium shot
Gestures	Iconic		Cowboy shot
	Metaphoric		Medium full shot
	Deictic		Full shot
	Beats	Camera movement	Approaching
Gaze	Floor		Move aside
	Back		Household
	Camera	Background	Green screen
	Cell phone screen		Animation
	Look aside	Cuts (instances/min)	-
Proxemics	Standing	Music	Mysterious
	Pacing		Cheerful
	Sitting		Relaxed

Embodied		Filmic	
Head movements	Tilt	Visual prompts	Image
	Shake		Text
	Nod		Movement
	Look aside		Video
Facial expression	Eyebrow-raising	Sound effects	-
	Frowning	Visual effects	-
	Smiling	Subtitles	-

For the analysis of engagement strategies within the Instagram *reels*, Bernad-Mechó and Valeiras-Jurado's (2023) taxonomy was utilized, as outlined in Table 3. These engagement strategies have been previously discussed in section 1.2 of the article.

Table 3. Engagement strategies variables. Taken from Bernad-Mechó and Valeiras-Jurado (2023, p. 9).

Engagement strategies
Emphasis
Dialogic involvement
Attention-getting
Control of responses
Humor

After the manual annotation of modes appearing in the *reels*, quantitative data was collected through the *Analytics* tool incorporated in the GRAPE-MARS software. This tool calculates the percentages in which each mode is annotated in the video analyzed. It is vital to remark that mode combination is part of multimodality, and that simultaneous mode occurrence was considered in the calculations of the final quantitative results. Hence, percentages for each mode appearance in the video could be calculated and coherently interpreted into qualitative results. However, it is important to note the challenges in quantifying certain modes, such as video cuts. Cuts, defined as sequence transitions within audiovisual postproduction, inherently complicate measurement through percentages due to their nature as transitions rather than continuous elements. To address this, the study implemented specific measures: cuts were quantified as instances per minute, and the speech rate was calculated in terms of words per minute rather than as a percentage. The compilation of quantitative data for all reels enabled a comparative analysis, underscoring the predominant modes in scientific dissemination via Instagram reels. This analysis provided a foundation for qualitative evaluations of common mode combinations in these videos. Moreover, the incorporation of both quantitative and qualitative assessments offered comprehensive insights into how engagement is cultivated within this emerging genre, contributing to the understanding of multimodal communication strategies in scientific dissemination on social media.

3. Results and discussion

3.1. Modal density of embodied and filmic modes

The analysis highlights the most prominent and recurrent modes within both the embodied and filmic frameworks of the Instagram reels examined, aligning with Bernad-Mechó's (2022) conception of modal density. This approach emphasizes the concentration of modes employed in tandem during communication. The percentages reported for both the embodied and filmic aspects are calculated as the weighted average of the quantitative data derived from the videos in the dataset. Table 4 details the quantitative findings related to the embodied modes.

Table 4. Results of embodied modes (% over total time of the clips).

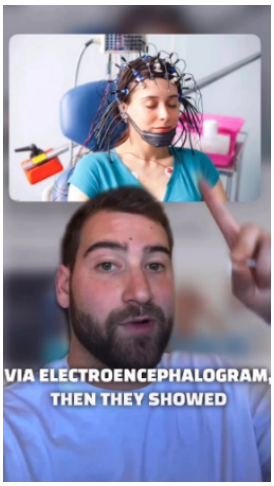
Embodied		
Spoken language	Spoken language	97.15
	Pauses	2.85
Prominence	-	16.51

Embodied		
Gestures	Iconic	6.22
	Metaphoric	11.04
	Deictic	24.79
	Beats	35.34
Gaze	Floor	0
	Back	0
	Camera	24.40
	Cell phone screen	50.28
	Look aside	25.32
Proxemics	Standing	35.61
	Pacing	0
	Sitting	47.86
Head movements	Tilt	5.43
	Shake	5.42
	Nod	5.81
	Look aside	6.33
Facial expression	Eyebrow-raising	4.84
	Frowning	15.06
	Smiling	11.27

The results reveal that spoken language accounts for 97.15% of the total duration of the selected *reels*. This remarkably high percentage of spoken language may be a defining trait of science dissemination Instagram *reels*, as speakers need to synthetise scientific explanations into short-length videos. Moreover, speakers often leverage spoken language to engage viewers by modulating their intonation to capture attention effectively.

Another significant embodied mode worth noting is the use of gestures, classified according to McNeill's taxonomy (1992) into iconic, metaphoric, deictic, and beat gestures. Among these, beat gestures emerged as the most recurrent, constituting 35.34% of the total duration of the selected videos. McNeill characterizes beat gestures as "a simple flick of the hand or fingers up and down; or back and forth" (1992, p. 15). Content creators often employ beat gestures to accentuate the pace of their explanations and inject dynamism into their verbal delivery. Additionally, deictic gestures emerged as the second most frequent gesture type, accounting for 24.79% of the duration of the *reels*. Deictic gestures involve pointing at elements, often incorporated during postproduction (filmic modes). Content creators utilize these gestures to direct viewers' attention to specific visual cues or elements within the video content, enhancing comprehension and engagement.

Figure 1. Example of embodied modes (V7).



A prominent embodied mode observed in the quantitative analysis of this study is the use of speakers' gaze. The results indicate that speakers looked at their cell phone screens for an average of 50.28% of the video duration. This tendency could be considered characteristic of science communicators on Instagram *reels*, as they often record videos using the front-facing camera of their mobile phones. Consequently, their gaze tends to be directed slightly below the camera lens towards the screen, where they can monitor framing and ensure visual quality during recording. While this prioritization of framing over direct eye contact with the audience may influence the information-conveying process, it should also be noted that the combined percentage of speakers' gaze directed towards both their cell phone screen (50.28%) and the camera (24.40%) totals a substantial 74.68%. This suggests that content creators aim to connect to their audience. Figure 1 illustrates this dynamic, depicting a screenshot in which the speaker is focused on his cell phone screen to monitor the video's frame and connect with the audience. Additionally, the use of a deictic gesture directs the viewers' attention to an illustrative image above him, enhancing the explanatory process.

Regarding the analysis of the filmic framework, the quantitative results obtained are detailed in Table 5.

Table 5. Results of filmic modes (%).

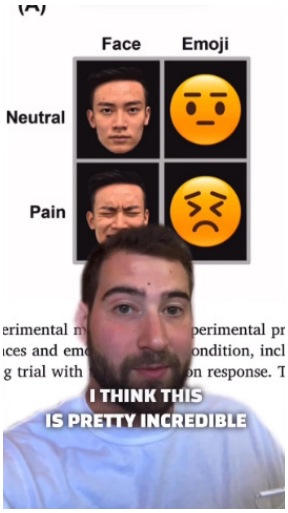
Filmic		
Type of shot	Close-up	0
	Medium close-up	99.67
	Medium shot	0.33
	Cowboy shot	0
	Medium full shot	0
	Full shot	0
Camera movement	Approaching	4.49
	Move aside	0.97
Background	Household	46.39
	Green screen	28.21
	Animation	25.40
Cuts (instances/min)	-	10.82
Music	Mysterious	19.67
	Cheerful	0
	Relaxed	11.54
Visual prompts	Image	48.38
	Text	5.18
	Movement	4.81
	Video	21.79
Sound effects	-	11.69
Visual effects	-	15.08
Subtitles	-	100

The results of the filmic modes analysis reveal that subtitles are present in all of the videos analyzed, accounting for 100% of their duration. This finding holds particular significance and suggests several potential reasons for the utilization of subtitles in these videos. Firstly, subtitles may serve to enhance viewers' comprehension of the explanations provided in the videos. Given the technical nature of scientific dissemination content, which often involves specialized vocabulary and complex data, providing written text alongside spoken narration can aid in clarifying concepts for viewers unfamiliar with the subject matter. Secondly, the inclusion of subtitles could be a strategic engagement element aimed at capturing the attention of users who come across the videos while browsing the "discover" section of Instagram. Since videos in this section are muted by default, subtitles serve as a means to convey information and entice potential new followers who may be intrigued by the visual content but have not yet enabled audio. Lastly, and most importantly, subtitles cater to users who may not be proficient in English, allowing them to follow along with the explanations more easily by reading the text. This consideration reflects a commitment to inclusivity and accessibility, ensuring that a wider audience can engage with and benefit from the scientific content presented in the reels.

Another prevalent filmic mode observed in these videos is the use of a medium close-up shot, which encompasses 99.67% of the total duration of the analyzed *reels*. This recurring choice of shot type may stem from science communicators' desire to cultivate a sense of intimacy and connection with their audience, a characteristic often associated with Instagram influencers, where personal connection and authenticity play crucial roles in engaging audiences. In other words, by employing medium close-up shots, content creators can effectively frame themselves within the video, allowing viewers to perceive them more closely and fostering a sense of familiarity. Furthermore, the medium close-up shot offers a balance between proximity and context, enabling communicators to convey their message closely while still allowing for enough space to include other elements on screen.

The background setting of the *reels* emerges as a potentially influential filmic mode in these videos. Specifically, the most common background observed in the selected *reels* was a household setting, constituting 46.39% of the total duration. This choice aligns with the notion that amateur-looking content can foster a sense of closeness and authenticity between communicators and their audience, as suggested by prior research (Muñoz Morcillo et al., 2016; Welbourne & Grant, 2016). Furthermore, the use of green screen backgrounds is also notable, comprising 28.21% of the video content. Creators often utilize green screens to illustrate procedures and research findings with visual materials. In fact, average of image visual prompts found in the dataset of this study was 48.38%, which accounts for almost half of the length of the *reels* selected. Figure 2 exemplifies this by depicting a screenshot in which the speaker, framed in a medium close-up shot, complements his verbal explanation about a scientific research article on emojis with subtitles and supporting images displayed on the green screen behind him.

Figure 2. Example of filmic modes (V7).



3.2. Engagement strategies

The quantitative data corresponding to the average engagement strategies found in the *reels* selected are shown in Table 6.

Table 6. Results of engagement strategies (%).

Engagement strategies	
Emphasis	16.52
Dialogic involvement	19.10
Attention-getting	11.01
Control of responses	24.02
Humour	2.27
TOTAL ENGAGEMENT STRATEGIES	50.42

It is crucial to acknowledge that engagement strategies often co-occur, resulting in the total sum of individual percentages exceeding the overall percentage of engagement time in the videos. The cumulative percentage of engagement strategies identified in the *reels* amounted to 50.42% of the total time, underscoring the significance of mode combination in engaging the audience within these science dissemination videos.

The most prominent engagement strategy observed was the control of responses, constituting 24.02% of the total duration. Communicators frequently utilize this strategy to generate anticipation and interest among

viewers by creating expectations about the upcoming content. For example, in the screenshot depicted in Figure 3, a text on top of the screen hints at the forthcoming presentation of "cooler" information, enticing viewers to continue watching. This strategic control of responses exemplifies the communicators' efforts to captivate and retain audience attention.

Figure 3. Example of control of responses (V2).

Other salient engagement strategies include dialogic involvement, accounting for 19.10% of the total duration, and emphasis, representing 16.52% (as depicted in Figures 4 and 5, respectively). Communicators on science dissemination Instagram *reels* employ dialogic involvement to establish a sense of relevance and connection with their audience, while emphasis is utilized to highlight specific aspects of their explanations. In Figure 4, for instance, the speaker employs dialogic involvement by using the word "us", referring to both the audience and herself, thereby fostering a sense of shared interest and implying that viewers and the speaker belong to the same group. This linguistic device encourages viewers to feel personally invested in the topic being discussed, thus inferring that they should care about the explanations that she is giving. Similarly, an instance of emphasis is depicted in Figure 5, where the speaker modulates her voice to a high pitch. This deliberate alteration in vocal tone serves to accentuate the significance of a key element in her discourse, drawing attention to it and reinforcing its importance in the viewers' perception.

Figure 4. Example of dialogic involvement (V2).

Figure 6. Example of emphasis (V2).

Another significant aspect contributing to user engagement in science dissemination Instagram reels is the frequency of cuts within the videos and the rate of speech exhibited by the communicators. The average number of cuts in the videos was 10.82 instances per minute, which is notoriously higher than the number of cuts in YouTube science dissemination videos, as examined in a previous study (Valeiras-Jurado & Bernad-Mechó, 2022): 2.98 instances per minute. This difference may also be linked to the average number of words spoken per minute by the communicators, which was 213.64. In contrast, the aforementioned study reported an average of 180.49 words per minute. These quantitative findings suggest that communicators in reels tend to speak at a faster pace than their counterparts on YouTube. The elevated rate of cuts and rapid speech pace observed in science dissemination Instagram *reels* aligns with the principles of dynamic editing reminiscent of MTV-style editing (Dancyger, 2011). This fast-paced editing approach is employed to maintain the audience's attention and retention by minimizing pauses and sustaining a constant flow of information. Moreover, research indicates that fast-paced discourse contributes to enhanced viewer attention and focus on content (Chambers, 2001). Thus, the combination of frequent cuts and rapid speech tempo in Instagram *reels* seems to serve to engage viewers and ensure the retention of their attention throughout the video duration.

4. Conclusions

The findings of this study lead to the following conclusions:

1. Instagram *reels* are to be defined as novel genre that may afford science dissemination.
2. Embodied and filmic modes play pivotal roles in conveying meaning within science dissemination Instagram *reels*.
3. Science communicators leverage a variety of engagement strategies within their Instagram reels to captivate and retain audience attention.

First, the characteristics of Instagram *reels* offer a novel audiovisual possibility to recontextualize and promote scientific content on social media platforms. The examination of some of their traits in this study, such as their modal density and engagement strategies, may serve as support to enhance the science promulgation potential of these types of videos.

Secondly, both embodied and filmic modes emerge as crucial components in the science dissemination process on Instagram. The modal density analysis conducted in this study confirms that specific modal ensembles are more prevalent and impactful than others. Embodied modes, encompassing elements such as spoken language, gestures, and gaze direction, serve as integral means of conveying meaning, aiding viewers in comprehending the explanations within the reels while fostering a sense of connection with the content creators. Furthermore, filmic modes, including background settings, medium close-up shots, and subtitles, are identified as techniques for audience engagement and enhancing information clarity.

Third, the analysis of engagement strategies used in science dissemination Instagram *reels* reveals that these videos are characterized by the extensive number of mode combinations used to engage the audience. This is a key aspect in digital genres, as retention of audience is paramount to effectively convey messages in media environments (Khan, 2017). The most prominent engagement strategies encountered in the science dissemination Instagram *reels* selected for this study were dialogic involvement, control of responses, and emphasis. Content creators employ control of responses techniques to raise viewers' expectations

of forthcoming information, dialogic involvement techniques to include the audience in their discourse, and emphasis to remark on key aspects of their explanations. In addition, it should be noted that the fast-paced editing of these videos, achieved through a high number of cuts and rapid spoken language, also contributes to engaging the spectators.

The empirical approach adopted in this study leads to considering some limitations that future research is invited to inquire about. One such limitation concerns the restricted dataset of videos utilized to assess the potential emergence of science dissemination Instagram *reels* as a novel digital genre. Although this paper presents examples of the use of Instagram reels for science dissemination, its findings cannot be generalizable, as a result of such restricted dataset. Future investigations could benefit from a broader selection of videos exhibiting diverse characteristics not addressed in this study, recognizing that multimodal analyses are inherently constrained by the complexity of their methodology. These further explorations may yield more nuanced quantitative and qualitative findings, thereby offering fresh perspectives to consider. Another limitation concerns the framework selected for evaluating the identified characteristics. This analysis focused on embodied modes, filmic modes, and engagement strategies adapted from existing taxonomies proposed by previous studies. However, exploring additional modes or approaches through multimodal analyses could enrich our understanding of the intricacies inherent in science dissemination Instagram *reels*. Moreover, researchers could explore the applicability of these videos in pedagogical contexts, such as EMI or ESP classrooms, to assess the potential didactic value of science dissemination Instagram *reels* in educational settings.

All in all, and despite the acknowledged limitations, this study seeks to illuminate the potential of academic content recontextualization and multimodal discourse analysis as methodologies to explore and describe emerging forms of communication. In an era where science dissemination is increasingly becoming essential in academia, one of the key implications is the need to raise awareness of the multimodal nature of communication and to provide training in multimodal literacy for both science disseminators and researchers. Acknowledging these new approaches to making scientific content accessible to broader audiences, and understanding how they function, holds the potential to have a significant impact on society. Ultimately, embracing these innovative approaches to communication can bridge the gap between academia and the public, fostering a more informed and engaged society.

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Credit Authorship Contribution

This paper follows a Sequence-determines-credit (SDC) approach to authorship. Elena Serrano-Hernández has contributed to the conceptualization of the study, the curation of data, the formal analysis, the investigation, methodology and validation of the study, and the writing of the original draft. Edgar Bernad-Mechó has contributed to the conceptualization of the study, the acquisition of funding, the development of the methodology and the software employed in the analysis. He has also overseen the supervision and carried out the reviewing and editing processes.

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