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An Exploratory Analysis of Citizen Science Web Texts: Understanding A Digital Genre in its Two Dimensions

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Abstract

Citizen Science projects have become increasingly important in the democratisation of scientific research, promoting public engagement and expanding the scope of scientific data collection through the citizen collaboration. This has led to an acceleration of scientific findings and scientific literacy among the general public. The present study explores the dissemination and analysis of two scientific projects launched in a citizen science e-platform by applying Askehave and Nielsen's (2005) two-dimensional genre model, that enables the exploration of digital genres in the reading mode and the navigating mode. Its purpose aims to explore linguistic features and communicative functions in the reading mode, and the use of multimodality and hypertextuality in the navigation mode. The findings show that scientists use language that is easy to understand and simple, and is reinforced by the numerous images and hyperlinks to adapt scientific content to audiences with little or no scientific background. The study can be used to inform the design of future scientific project and support public science communication.

Resumen

Los proyectos de Ciencia Ciudadana se han vuelto cada vez más importantes en la democratización de la investigación científica, promoviendo la participación pública y ampliando el alcance recopilatorio de datos científicos a través de la colaboración ciudadana. Esto ha llevado a una aceleración de los hallazgos científicos y el conocimiento científico entre el público en general. El presente estudio explora la divulgación y análisis de dos proyectos científicos lanzados en una plataforma electrónica de ciencia ciudadana aplicando el modelo de género bidimensional de Askehave y Nielsen (2005), que permite la exploración de géneros digitales en el modo lectura y en el modo navegación. Su propósito trata de explorar los rasgos lingüísticos y funciones comunicativas en el modo lectura, y el uso de la multimodalidad y la hipertextualidad en el modo navegación. Los resultados muestran que los científicos utilizan un lenguaje fácil de entender y sencillo, y que se ve reforzado por numerosas imágenes e hipervínculos para adaptar el contenido científico a audiencias con escasa formación o ningún tipo de conocimiento. El estudio se puede utilizar para informar sobre el diseño de futuros proyectos científicos y apoyar la comunicación pública de la ciencia.

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Contents

1. Introduction

Digital media are closely associated with the popularisation of information and communication technology (ICT) and the use of the Internet. Moreover, increased use of digital devices has transformed the way people express, write, read and connect socially. This is what Jones and Hafner (2012) refer to as 'digital literacies'. As these authors explain, being able to use media is 'the ability to creatively engage in particular social practices […] to form or maintain various social relationships, we use the term "literacies"' (Jones and Hafner, 2012, p. 12). Stated differently, digital literacy is not only a technical or cognitive skill but also a social skill. A new characteristic of texts in digital media is that they cannot only be read in the traditional way, as we do with a physical print text. They are read in the manner the reader (the web navigator) wishes to. For instance, if the reader does not want to skim the whole page, s/he can directly access the information directly via a hyperlink, either from an external link or an embedded link within the webpage. This understanding of web texts is described by Askehave and Nielsen (2005) and theorised in their article 'Digital genres: a challenge to traditional genre theory'. These authors draw upon Swales' (1990) genre theory as a point of departure but further expand it to propose that a digital text is both genre and medium, and therefore, needs to be characterised taking into account two different modes: the reading mode, in which the rhetorical strategies (verbal and visual) accomplish communicative functions, realising the communicative purposes of the text; and the navigating mode, in order to understand how links and hyperlinks fulfil the communicative purposes of the text. The text receiver thus plays two roles, the role of the reader of the text and the role of the navigator of the text hypertext (Askehave and Nielsen, 2005, p.128). Askehave and Nielsen illustrate this two-dimensional model

taking the case of a corporate homepage, but explain that the model can be applied to other digital genres such as blogs, social networks, or public scientific project online such as crowdfunding and Citizen Science (CS hereafter) projects. The latter type, CS projects, are defined as 'the practice of public participation and collaboration in scientific research to increase scientific knowledge' (*Encyclopedia of National Geographic*, n.d.). Through its participatory approach and open sharing of data and findings, CS exemplifies the ethos of Open Science, which involves the democratisation of scientific research while fostering cooperation between experts and the public.

According to Burgelman et al. (2019), 'Open science in essence refers to the transformation that science is undergoing due to globalisation and ICT […]'. Open Science policies promote science democratisation, which has been discussed by a growing body of literature that recognises the importance of making science collaborative between scientists and citizens (Bartling and Friesike, 2014). This new paradigm in science advocates for a belief of expanding openness in which science can be reachable to a wider audience where digital innovations permit scientists to publish and share their research findings to a non-expert and amateur audience (Bartling and Friesike, 2014, p. 19). Open Science is not only the result of technological innovations but rather of a profound sociological change that pushes towards a more participatory framework that ultimately leads to the democratisation of knowledge (Luzón and Pérez-Llantada, 2023, p. 43). Therefore, it could be said that a key concept is its transparency, openness, connectivity and accessibility of knowledge that is shared and developed through collaborative networks involving experts and non-experts in online interactions. To make science a cooperative activity, the specialised content needs to be adapted through rhetorical strategies and engagement techniques so that researchers can get asynchronous collaboration and assistance from citizens in the examination of data and

insights to the scientific research itself. In order to make the public enrol on scientific projects, researchers rely on language resources to make content accessible to such public (Pérez-Llantada, 2023). Overall, it is paramount to understand that Open Science requires cooperation between the scientific community and citizens, working together on research. Citizen volunteers search, analyse and classify information with the purpose of learning scientific knowledge and helping researchers with their investigations (Luzón and Pérez-Llantada, 2022). Furthermore, Fecher and Friesike (2014) point out that research process should be characterised by 'becoming transparent and accessible' (Fecher and Friesike, 2014, p. 19). Therefore, the main goal of Citizen Science projects is to educate and make people aware of issues related to environmental sustainability and other issues of social concern. Thanks to its accessibility, citizens can engage in online volunteering activities (for example, in the classifying and collecting of scientific data) and by these means support the scientists' work. According to Bonney et al. (2009) 'Citizen science projects have been remarkably successful in advancing scientific knowledge' (p. 977), not only by accelerating the process of scientific research but also by providing amateurs with learning opportunities for increasing their scientific literacy. It can thus be said that Citizen Science projects require the active participation of citizens and amateurs. This collaborative network can be realised thanks to the accessibility of Internet and digital media.

The purpose of this dissertation is to explore how online scientific content is communicated in projects of Citizen Science that appeal to the participation of non-expert audiences. The aim is to analyse communication from Askehave and Nielsen's (2005) theory, as their study offers a comprehensive empirical analysis on web-mediated projects characterised by the two-modal processes: the reading mode and the navigation mode. Together, these two processes will provide relevant insights into the

analysis and purpose of language and multimodality in online scientific websites of Citizen Science projects. Therefore, this dissertation sets out to answer the following questions:

- What kind of language characterises web-mediated CS projects and what are the communicative functions of verbal strategies when analysing the projects in the reading mode?
- How is multimodality used in these digital texts?
- How is hypertextuality used in the websites of the selected CS projects when analysing these projects in the navigating mode?

I aim to explain why language is mediated as such in Citizen Science projects considering that researchers target non-expert participants in order to perform specific scientific tasks, that thereby improving their scientific processes and, as a result of this collaboration, citizens' understanding of science.

2. Methodology

This study draws on case study research to understand how two citizen science projects are constructed in a web environment and do so by exploring the linguistic, multimodal and hypertextual elements in both the reading mode and the navigating mode, following Askehave and Nielsen (2005). The digital texts selected for the study were extracted from a citizen science platform called Zooniverse, which is 'the world's largest and most popular platform for people-powered research' (Zooniverse, 2007). Specifically, I have focused on two projects on the same topic: birds and their nesting habits. The selected projects were: 'Wildwatch Burrowing Owl' and 'Woodpecker Cavity Cam' (Table 1). The analysis specifically focused on the text, visuals and hypertextual features of the 'About' page of these projects, as this is the page in which the scientists explain their projects in a language that is accessible to broad, non-expert publics. Therefore, the verbal and visual data of the two pages was extracted for further analysis following Askehave and Nielsen (2005), as previously stated.

Table 1. Data sources

Name of the project	Website link	Types	Tokens
Red-headed Woodpecker Project	https://www.zooniverse.org/projects/elwest/woodpecker-cavity-cam/about/research	455	1,105
Burrowing Owl Project	https://www.zooniverse.org/projects/sandiegozooglobal/wildwatch-burrowing-owl/about/research	475	888

Additionally, the contextual features of the text were taken into consideration (Flowerdew, 2002, 2011; Paltridge 2012) to understand these web texts. Paltridge (2012, p. 78) explains that each text is shaped by several contextual factors, such as the

focus and perspective of the text; the communicative goals or purpose(s) of the text; its target audience, the relationship between the writer and the reader, and the relationship of the text with other texts. According to Yates and Orlikowski (2007) these contextual aspects of the genre, or type of discourse that these exemplars of CS projects exemplify, are 'deeply intertwined'. In the two Zooniverse projects, 'Wildwatch Burrowing Owl' and 'Woodpecker Cavity Cam', the two texts take place on an online setting, or virtual environment. The main focus of the texts is the study of the behaviour of two North American birds that are threatened to be locally extinct and aim to decrease the rates of extinction. The intended audience is the general public who are not experts in the matter but who are nonetheless willing to support and participate in the project. Their main role is to understand the workflows that the research team has designed for them to complete the texts and gain knowledge about the current situation of the birds. The relationship that exists between writers and readers aims first, at creating a better understanding of both the purpose of the scientific group and the tropic; and second, it is aimed to induce an active engagement and collaboration on the part of the reader so that collaboration can take place. Is therefore expected that the participants will have questions about the workflow, and thus, according to the project guidelines, one of the sections is a FAQ with the aim of creating a closer community including experts and non-experts. Concerning the background knowledge, the reader does not generally need any previous knowledge on the topic of the project. Nevertheless, it is assumed that values between the two parts are shared because both seek an improvement on the issue and this is a feature commonly found on Zooniverse, hence the reason why it is called a 'people-powered research' platform.

Regarding the analysis of the website in the reading mode, a linguistic analysis of the text was carried out to identify recurring linguistic resources and their

communicative functions at the level of discourse. To identify linguistic resources, corpus assisted discourse methods were used (e.g., frequency lists and analysis of keywords in context). I first used the software AntConc (version 4.2.4) developed by Laurence Anthony to identify the words that occurred most frequent, and that hence were the main carriers of semantic meaning of the texts. The total word count of the projects analysed was 5,471 words.

Web texts characterised by the exploitation of the hypertext medium through hyperlinks. As the Cambridge Business English Dictionary defines, a hyperlink is a 'word, phrase or image on a website or in a computer document which you click in order to go to a different website, different part of the document, etc.' (Cambridge Business English Dictionary, n.d.). In order to classify multimodal elements, the taxonomy proposed by Jones and Hafner (2012) was used. To classify types of hyperlinks and analyse its functions and multimodality on the two projects the taxonomy proposed by Askehave and Nielsen (2005) was used. Zooniverse allows researchers and volunteers to collaborate and make discoveries together. In the subpage 'Build a project' where guidelines are given on 'How to do things in the Zooniverse', concerning the About subpage, the guidelines indicate that the author can add 'all sorts of additional pages, including *Research Team, Results, Education* and *FAQ*' meaning that while the creator(s) have a degree of autonomy to be creative on the project, the creator still needs to follow a specific model of subpages that are likely to be used by the public audience. Another subpage deals with the content of the media specifying the researcher(s)'s images cannot be duplicated in the workflow(s) aimed at volunteers. This results in simple images with enhancement purposes to increase the engagement of non-expert audiences. Essentially, these guidelines were valuable for exploring, disseminating and understanding the way CS projects are created to engage citizens.

3. Results

Case 1. Woodpecker Cavity Cam

Reading Mode

The analysis of the About subpage of this project showed that the inclusion of technical terminology or evidence such as statistics adds detail to the description of the context of the project. For the technical terminology, the nomenclature used in the sentence 'Read-headed woodpeckers (*Melanerpes erythrocephalus*)'; and for the statistics, 'declines estimated at 67% since 1970'.

Figure 1. Screenshot of About WCC Project

This project addresses the two concerns – climate change and environmental hostility – by focusing on the North American bird. Therefore, this is the reason why the research team and Dr Elena West, the research group leader, seek to fill

‘information gaps about red-headed woodpecker ecology’ to gain a better understanding of the behaviour of birds that use tree cavities for nesting and roosting and their relationships with other animals in the community such as bats, squirrels, mice and tree frogs. The scientists inform about the project and by installing several cameras near the red-headed woodpecker cavities, they expect that the citizens identify which wildlife is featured on and their activity pattern from the thousands of videos that the cameras would record. Only in one workflow (‘Woodpecker Days and Nights workflow’) out of the three workflows (‘Animal or Not workflow’ and ‘Cavity Visitors workflow’), the citizen-volunteers are expected to have some background knowledge of red-headed woodpeckers, stated as follows: ‘This workflow is aimed at volunteers with background in birding and/or a specific interest in red-headed woodpeckers. We ask for detailed information about age classes, age-specific behaviors, identifying bands, and more’ (Zooniverse, ‘Woodpecker Cavity Cam Project’). However, the remaining workflows are aimed at amateurs with no background knowledge of woodpeckers or the birds’ habitat. In ‘Animal or Not workflow’ the text specifies that ‘[it] is great low-stakes, easy entry into the Woodpecker Cavity Cam project! You don’t need to know anything about oak savannas, Minnesota wildlife or red-headed woodpeckers to make a big difference to our work’ (Zooniverse, ‘Woodpecker Cavity Cam Project’). The same applies to the ‘Cavity Visitors workflow’: ‘Each video is classified by multiple independent volunteers, so don’t worry if you are not an expert in animal ID’ (Zooniverse, ‘Woodpecker Cavity Cam Project’).

In the Woodpecker project, the most frequent lexical word in the frequency list is the second person pronoun ‘you’ (16 occurrences, 14.4 per 1,000 words), which directly involves the reader by wanting to persuade him/her to do a specific action. Some examples are ‘As a volunteer on this project, *you* will help us quickly identify

which of our thousands of videos contain wildlife, which wildlife are featured, and what they are doing.' Or 'Your work is important to the success of the Woodpecker Cavity Cam project, and we're so happy to have *you* with us!'. In the first example the pronoun is followed by the modal verb 'will', conveying assertiveness. The main verb 'help' is followed by the object pronoun 'us', referring to the research group. The use of the second person pronoun indicates that the discourse establishes a dialogical relationship between the writer and the reader. In addition, the other highly frequency rate nouns are 'cavity' (14), 'woodpecker' (14) and 'workflow' (13). The fact that these nouns were high frequency words in the frequency list indicates that the content of the text centres around these nouns. Table 2 shows some examples of these semantically related high-frequency words, which indicate that the scientists' main goal is to engage their audience in a scientific research process.

Table 2. Lexical semantic words

Noun	Frequency of occurrences	Example
Cavity	14	This noun indicates what aspect of woodpeckers the citizens need to focus on. The methodology of the research project is to install a trail of cameras in the tree cavities, hence the high frequency of the noun. For example, 'Your work is important to the success of the Woodpecker *Cavity* Cam project, and we're so happy to have you with us.' This word is usually preceded by 'woodpecker' and followed by 'cam' or 'visitors'.
Woodpecker	14	This word refers to the common name of the North American bird, rather than using the binomial nomenclature (mentioned at the beginning of the text). Another communicative function is to make it clear to the citizens that this is a distinct species, different from other animal species such as mice, frogs or squirrels that also use the same tree cavities. For example, 'Each

		workflow is essential to our project and to our understanding of life at *woodpecker* nest cavities.' This word is not preceded by any repeated word but it is accompanied in its immediate context by the noun 'Cavity' or 'Days'. The same is true of the second noun.
Workflow	13	It refers specifically to the task that the participants have to carry out. In this case, the analysis and identification of red-headed woodpeckers and other wildlife found on the video recording in order to study their behavioural patterns and their relationship with other wildlife species. For example: 'Each *workflow* is essential to our project and to our understanding of life at woodpecker nest cavities.'
Project	10	This noun refers to the whole project. It combines with the words 'cavity' and 'woodpecker' to form a noun compound that makes its semantic meaning explicit. For example, 'Your work is important to the success of the Woodpecker Cavity Cam *project* […]'. This combination occurs four times plus one more time with a slight variation: 'The Woodpecker Cavity Cam sub-*project* began […].'
Videos	10	This plural noun is closely related to other especially frequent words, 'project' and 'workflow'. The research team has provided the citizen-volunteers with several video recordings in tree cavities showing daily habits of woodpeckers and other wildlife animals. Therefore, the volunteers have to contribute to the workflow by looking at several videos that have been recorded by the cameras. Some examples are: 'If you have classified *videos* in the Cavity Visitors workflow […]'; Or the sentence: '*Videos* that are marked as containing red-headed woodpeckers move from the Cavity Visitors workflow over to the Woodpecker Days and Nights workflow.' This noun is always mentioned with the idea of 'workflow' or 'cavity visitors', thus contributing to the explicitness of the text.

The frequency list also showed that the function words 'and (43) and 'to' (39) occur frequently (Table 3). The coordinating conjunction, occurs 43 times (3.89 per

1,000 words) and is the most frequent function word in the list. A closer analysis of the text shows that there is a noticeable use at a phrase level compared to the conjunctions used at a sentence level (69.77% at phrase level vs 30.23% at sentence level). More specifically, the results show that there is a frequency rate of 30 occurrences of 'and' at phrase level in contraposition with the 13 occurrences at a sentence level, suggesting that this conjunction serves to make the discourse more explicit. According to Biber (2006) 'the preferred use [of 'and'] in conversation is the clausal' (p. 700) or sentence level use. Hence, the presence of this linguistic element at the level of the phrase indicates that the information is packaged, thus contributes to explicitness in meaning making. Since this is a CS project that seeks citizen's collaboration, it is not surprising to find instances of coordinating conjunctions at a phrase level that make the message as explicit and clear as possible.

Table 3. Other highly frequent words

Word	Frequency of occurence	Example
And	43	Many working as a coordinating conjunction, as in examples such as: This population decline is presumably due to the loss of preferred nesting habitat in open woodlands and savannah-like grasslands that contain dead limbs and snags for nesting and roosting; 'we installed a series of trail cameras near red-headed woodpecker cavities to capture the behaviours and interactions of the community of animals that depend on these holes'
To	39	For example, 'Building on volunteer monitoring work begun in 2008, a team of researchers led by Dr Elena West began additional work in 2017 to address key information gaps about red-headed woodpecker ecology.'
You	16	-Subject pronoun: '[…] that *you* are able to give us the best possible data!' -Object pronoun: […] that feels the most rewarding to *you*'.

As also seen in Table 3, the word ‘to’ is also highly frequent, with 39 occurrences (3.53 per 1,000 words). From the total occurrences of ‘to’, there are 24 instances that are *to*-infinitive clauses, which makes up a percentage of 69.23%. *To*-infinitive clauses introduce the purpose of an action and thus help the readers understand the topic and the task that needs to be done. These clauses convey purpose and make it clear what specific action needs to be fulfilled, as in ‘[…] we installed a series of trail cameras near red-headed woodpecker cavities *to capture* the behaviors and interactions of the community […]’; ‘[…]’. In sum, statements of purpose add clarity to the text and make it clear to citizen-volunteers what the purpose of the classification is.

Finally, the linguistic form ‘you’, a reader mention, showed a frequency of 16 occurrences (14.4 per 1,000 words) (Table 3). This form shows a much lower frequency of occurrence compared to ‘we’. ‘You’ works as both a subject pronoun (81.25%) and an object pronoun (18.75%). This difference shows that the subject pronoun makes it clearer to whom the text is referring, in this case, to the citizen-volunteers. The object pronoun is usually used in order to convey or establish a relationship through empathy and proximity, indicating that the reader is being addressed. It is important to note that there are more pronouns in the second person than in the first person (9 occurrences; 0.81 per 1,000 words), indicating that the researcher team addresses the reader directly. This rhetorical strategy aims to create proximity with the readers, emphasising the important role of citizen-volunteers in this online interaction.

Navigating Mode

Turning now to the second part of the analysis of the Red-headed Woodpecker Project the results of the analysis of the web texts in the navigating mode the functions of multimodality and hypertextuality and their rhetorical effects are summarised in this section. The digital medium is characterised by the fact that, unlike the traditional printed text, it becomes interactive through the presence of hyperlinks as an affordance of navigational possibilities by enhancing and expanding the content of the project website. As explained by Askehave and Nielsen (2005) hypertexts on a digital webpage 'contain links which provide access to other sites on the web, their genre status and function change […]' (p. 129). This is the case of the project. In addition to these hyperlinking affordances, several multimodal elements create rhetorical effects. The most prominent element is the use of photographs accompanying the text. A total of seven images. All but two show the research site and other cavity visitors such as two squirrels. The remaining two show a red-headed woodpecker. In Figure 2, we see red-headed woodpecker near a cavity with something in its beak. It is probably a female woodpecker, as we can see a young red-headed woodpecker in the tree cavity, which can be easily identified by its 'brownish-grey head, neck, and throat' according to the 'Field Guide' section of the Red-headed Woodpecker Project.

Figure 2. Image of a red-headed woodpecker with a juvenile in the About WCC Project

The second photograph (Figure 3) shows project's secondary objective, which includes the preservation of ecosystems and oak savannas to provide a suitable habitat for red-headed woodpeckers. The specific location, east central Minnesota, appears in the third image where the Cedar Creek Ecosystem Science Reserve is mentioned. It is worth noting that this name contains hyperlinked content and that the first hyperlink (out of five hyperlinks) that appears in the text is the first one. As can be seen in Figure 4, the navigator is able to identify the place, the Reserve, because of the distinct colour (in this case, blue) and the underlining, which indicates that there is a link that takes us either within the webpage or to externally hyperlinked content. In this case, it redirects us to the homepage of Cedar Creek Long Term Ecological Research Site that is known for being a site for ecological research and is closely linked to the University of Minnesota (USA).

Figure 3. Image of the habitat of About WCC Project

Figure 3 is accompanied by a series of images (four to be precise): the installation of the cameras by a worker on a metal ladder leaning against a tree, a photograph showing the actual size of a red-headed woodpecker compared to a hand, the map of the state of Minnesota and the small green dot or square indicating the exact location, followed by an enlarged image of the location. At the top of the image, there are two additional hyperlinks. The first one refers to the leader of the research team, Dr Elena West and this name takes the reader to a page within the same project which is the part of 'The Team' where the reader can find out about the whole team, along with the funding acknowledgements namely, Minnesota Environment and Natural Resources Trust Find and the Audubon Chapter of Minneapolis. The third hyperlink takes the web navigator to the homepage of Dr Elena West's blog, the leader of the research. This link is provided in case the reader wants to learn more about the research and the projects that she is leading, and the name of the blog is 'Red-headed Woodpecker Research and Recovery'.

Figure 4. Screenshot of the 'Research Location' in About WCC Project

In the Project Goals section of this About text, Figure 5 shows an example of what the cameras track in the project. The difference between this photograph and the previous ones is that the point of view is different because it has been taken from the trail camera installed by the research team. The navigator can deduce this from the date and time information situated up on the top left part of the photo and the temperature in degrees Fahrenheit on the right, all of which provide valuable data for studying the scientific samples and posting them on the website of Zooniverse for citizen volunteers to classify, help with and ultimately contribute to the scientific research on red-headed woodpeckers.

Figure 5. Screenshot of Project Goals in About WCC Project

This is followed by text explaining the role of volunteers (Figure 6) and the three workflows, which are detailed in the next sections of the text. In The Role of Volunteers section, Figure 6 begins to involve the volunteers, the most prominent element being a graphic that provides an overview of the whole process. It starts by saying ‘With your help going through the videos that the cameras capture, we hope to learn lots of valuable new information!’

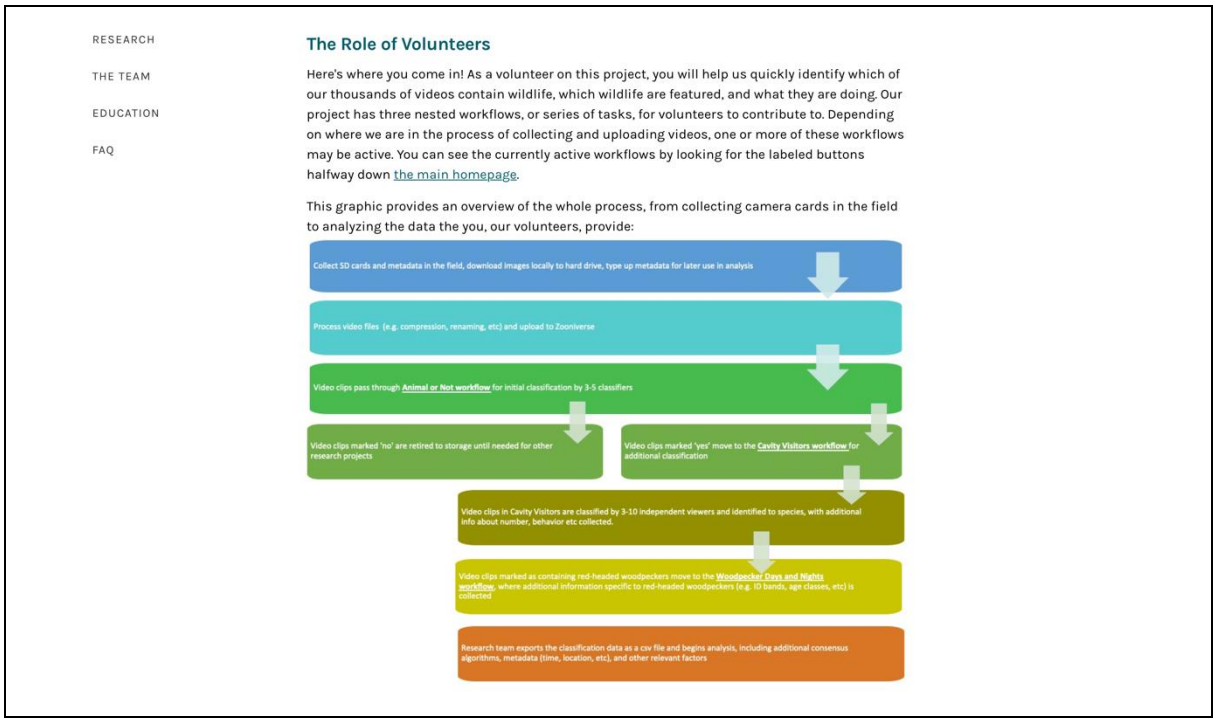

Figure 6. Screenshot of The Role of Volunteers in About WCC Project

There are three workflows ('Animal or Not workflow', 'Cavity Visitors workflow' and 'Woodpecker Days and Nights workflow') that volunteers can choose to work on with the aim of collaborating with the research team. As explained in the graphic, the material produced by the citizen scientists would be collected by the scientific research team in order to analyse and obtain the relevant information. There is only one hyperlink in this section of the text, the main homepage, which takes the user to the project's main webpage if they wish to select particular workflow. Curiously, there are no images for the first workflow, the one called 'Animal or Not workflow', because as the main page states 'Not all workflows will be available at all times' and it appears that there are only two available workflows. In the 'Cavity Visitors workflow' (Figure 7) we find an image of other animal species, in this case a squirrel with its baby situated in the tree cavity, suggesting that there are other animal interactions that can take place in nest cavities.

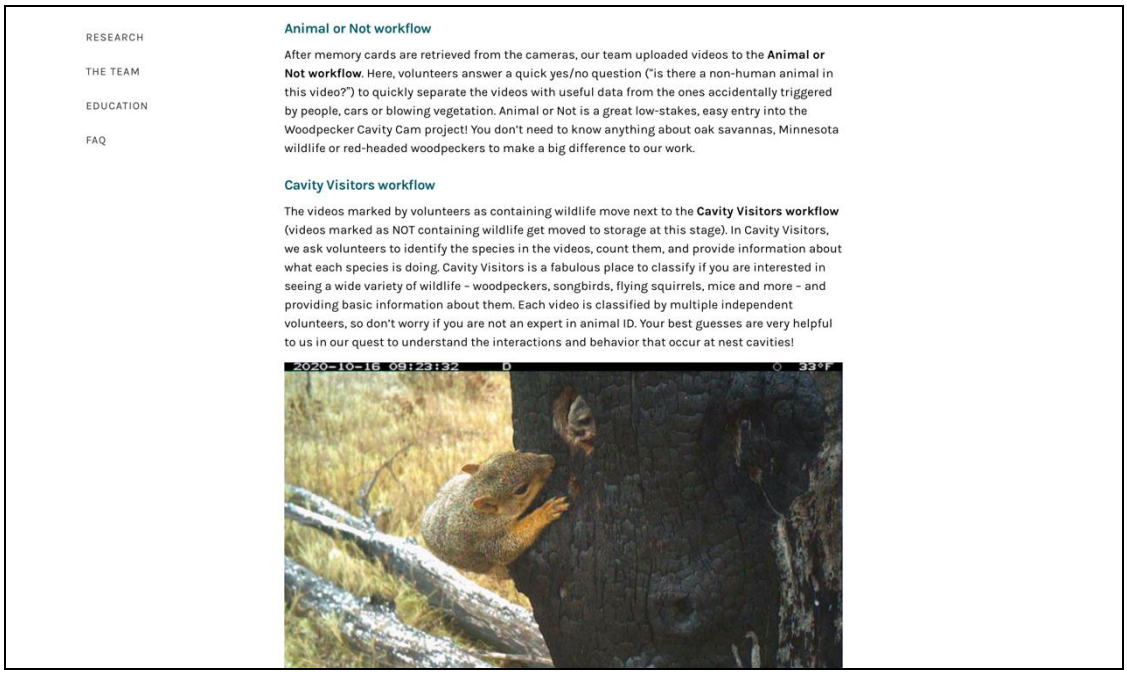

Figure 7. Screenshot first and second workflow in About WCC Project

In the next section of the text, describing the 'Woodpecker Days and Nights workflow' (Figure 8), we find a photograph of two adult red-headed woodpeckers, one inside the tree cavity and one on the trunk of the tree. As they are not as distinct as the squirrel or the physical differences between a juvenile and an adult red-headed woodpecker, this workflow is aimed at more experienced volunteers, who are asked to identify specific elements and detailed information on age classes, age-specific behaviour or identification bands, among other things.

Figure 8. Screenshot third workflow in About WCC Project

The last paragraph of the text includes one final photograph and a hyperlink (Figure 9). The internal hyperlink takes the navigator to the 'FAQ page' in case he/she has questions and mentions the 'Field Guide' which is not a hyperlink itself but an additional tab located on the right part of the screen. The 'Frequently Asked Questions' page is a separate subpage within the same project (next to the 'About' page), where possible questions are answered in detail, and some, with more hyperlinks (external, like the Snapshot Serengeti blog; and internal, taking the navigator to the About page or the homepage of the Project). The last image is concurrent with the name of the project itself 'Woodpecker Cavity Cam'. It is more immediate than the verbal message. We see a red-headed woodpecker on a tree, close to a cavity (although it is not visible in the picture) and an installed camera recording every movement of the American bird.

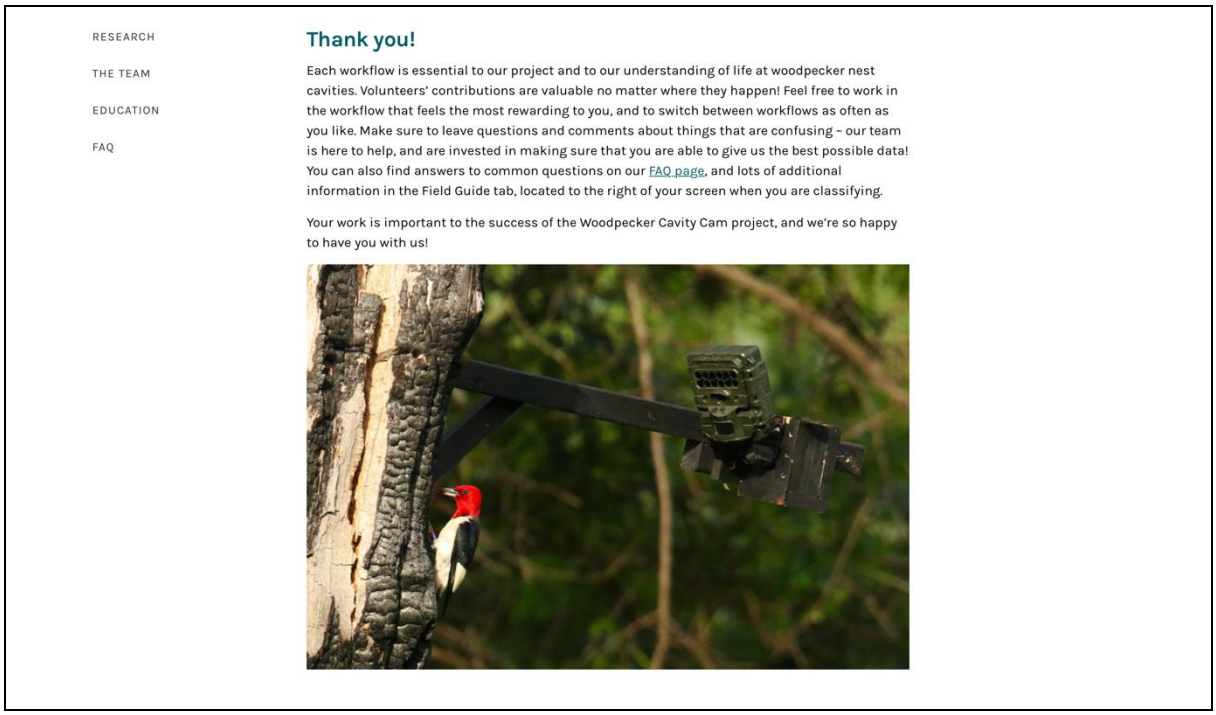

Figure 9. Image of a red-headed woodpecker and an installed camera from WCC Project

The colours in the photographs are red, brown and black with the most contrasting colour being the red found on the woodpecker's head, hence the name of the North American bird. This can give a sense of nature and elements associated with ecology and the preservation of the habitat of the woodpecker and its species due to its rapid decline in the Midwest and Eastern parts of the United States.

Case 2. Burrowing Owl

Reading Mode

The project called 'The Burrowing Owl' provides information and seeks the help of citizens to help this North American bird, which is mainly found in southern California (USA). The text is written in a simple way to make the information clear and precise. Technical terms or scientific nomenclature are used at the beginning of the text to introduce the topic: 'The western burrowing owl *Athene cunicularia hypugaea', which serves to build credibility and trust in the research being carried out by the scientists in this project. In addition, the first sentence sets the context of the bird species by stating its location (San Diego County) and the scientific challenge associated with it, namely the fact that fact that it 'is at risk of going locally extinct.*

This explicit reasoning makes the focal point, the burrowing owl, the catalyst for gathering support and help from the citizen volunteers. The project, which can be found on the Zooniverse website, is the brainchild of a group of scientists led by Dr Melissa Merrick. As mentioned above, the main goal of the project is to reduce or 'reverse the decline' of the burrowing owl. To achieve this goal, the team proposes to redesign and build suitable habitats by creating artificial burrows that will encourage the colonisation of this North American bird. To make it easier for the owls they would also introduce other animal species that build burrows such as the Californian ground squirrel, to give them a sense of a natural habitat. According to the text in the Project of Zooniverse, scientists would be able to study and understand what they call 'burrowing owl ecology', which involves many aspects of the life of a burrowing owl including reproductive rates, nest success and survival, among other elements. To achieve this, as stated in the About Research subpage of this project, the team would set up field cameras outside the constructed burrow, which would serve to observe the birds'

behaviour. Once the images have been taken, the citizen volunteers would help to classify the burrowing owl photos according to several characteristics, namely number of birds, age stage, activity and prey items. There is only one possible task for this project, unlike the woodpecker project. However, although it is a single project, there are many elements to consider. In fact, the sections entitled 'They Grow Up So Fast' and 'Fun Facts' give additional information that is relevant in order to do the task. The final section of the text focuses on 'Project Goals', where they provide information about the specific location (Otay Mesa) and summarise the main objectives of the project.

Turning first to the linguistic features of the verbal text, the most frequent words at the top of the frequency list are 'to' (21 occurrences), followed by 'and' (21) and 'can' (10). While the first two are functional words, the third most frequent word, the modal verb 'can' gives us an indication of how the text appeals persuasively to potential future volunteers The pronoun 'you' (8) is also particularly common, appealing directly to the citizens. In terms of content words (Table 4), the most frequent words are 'burrowing' (13), 'owl' (11) and 'chicks' (8).

Table 4. Highly frequent words

Noun	Frequency of occurrence	Example
Burrowing	13	This noun refers to a species of owl that the team is studying and the bird that the task will focus on. The reason for this name is that the North American species are characteristically dependent on burrows to thrive as they are found in open habitats. Therefore, it is common to see this noun when referring to the owl, because it specifies the type of owl that the project is working on. For example, 'One of the best ways to understand *burrowing* owl ecology […]'.

Owl	11	Almost as frequent as the previous noun, this word is a key semantic word because it reinforces the main goal of the project, to reduce the process of local extinction of this species of owls by understanding and learning behavioural patterns. For example, 'One of the best ways to understand burrowing *owl* ecology […]'.
Chicks	8	This noun is slightly less frequent because the project is not only focused on burrowing owl chicks. However, it is important because the main goal of the project is to increase the number of burrowing owls in the area of southern California, then it is expected that chicks of this species will be found, one of the footage images in the task may include the new-borns or juvenile burrowing owls. For example, 'The chicks don't emerge from the burrow until they are about 2 weeks old.'

In general terms, the research team intends to engage with the audience by presenting their scientific project, aimed at counteracting the local extinction of burrowing owls in southern part California, specifically in San Diego. The most frequent words were related to the type of bird and the word 'chicks' is the result when a species is found in a favourable environment implying that the project seems to be successful enough.

With regards to the function words identified in the frequency list, 'to' (21), 'and' (20), 'they' (13) and 'can' (11) we can further comment on the following aspects. 'To' mainly introduces *to*-infinitive clauses (Table 5).

Table 5. Other highly frequent words

Word	Frequency of occurrence	Example
		-*To*-infinitive: '*To* help reverse the decline […]' or '*To* give observers a clear context of the behavior

To	21	[…].' -Preposition: '[…] it could be anything from a grasshopper *to* a snake' or '[…] pose significant risks *to* these populations.'
And	20	-At phrase level: 'First, male *and* female burrowing owls […]' -At sentence level: 'At this point, they are grey with white down *and* haven't quite grown […]'
Can	10	In this text, the modal verb is acting as a reassuring modal verb inviting participation. E.g., '[…] you *can* help us classify burrowing owl photos, […]'.

The coordinating conjunction 'and' is used at both phrase level and sentence level. In this text, there are 12 instances (60%) of phrase level coordination using 'and'. Some instances of the coordinating conjunction at phrase level are: '[…] into the "*fluffy and buffy*" stage'; '[…] San Diego Zoo Wildlife Alliance's Burrowing Owl Recovery Program is working with […] to address burrowing owl *ecology and conservation* practices in Southern California'; 'First, *male and female* burrowing owls […]'; 'You get to *classify and decide*!'. There are 8 instances of 'and' at sentence level: 'The chicks practice flying […] *and* pouncing […]'; '[…] their eyes open *and* they start making […]'; 'At this point, they are grey with white down *and* haven't quite grown […]'; 'Our study of population dynamics in Otay Mesa is on-going, *and* you can help add to our understanding.'

Another highly frequent word in this subpage is 'to' (21 occurrences) 'To' performs two textual functions: a *to*-infinitive clause introducing finality and a preposition. There are 13 instances of 'to' introducing *to*-infinitive clauses that serve to indicate finality (e.g., 'You get to classify and decide'), amounting to 62% of all

occurrences. Again, then, we can deduce that the text wants to use direct and clear information about the main goal of the project is and the task that the participants have to fulfil. The modal verb 'can' (10) is accompanied by main verbs. Usually, this modal verb is used to express advice or suggestions; for instance: '[…] and you *can* help add to our understanding […]'; 'This *can* result in the oldest chicks being up to two weeks older […]'; 'The juveniles *can* usually be identified […]'; '[…] you *can* help us classify burrowing owl photos […]'. The use of these highly frequent words indicates that language is used to describe science and actions in detailed and clear manner while also inviting the public to participate.

Navigating Mode

The analysis of the text in the navigation mode shows that the use of visual rhetorical strategies and on the role of hypertextual links in this project is also important. In this project, there are fewer images and fewer hyperlinks than in the previous project. In total, three photographs and no hyperlinks. However, there is an embedded video posted by the San Diego Zoo (according to the username), which can send the navigator to an external link outside the online platform of Zooniverse, in this case, to a YouTube page. This external link is located at the bottom of the text in the About Research website, and is displayed in such a way that the navigator does not necessarily have to access the external link. It is a type of external link that easily takes the navigator to an external website (YouTube link). The video introduces Colleen Wisinski, a conservation biologist, who explains the situation of the burrowing owls in the San Diego County area and the programme that they are carrying out to reduce the extinction of the local American bird. The clip ends with some of the results of the scientific research, such as

the local impact in terms of general knowledge about burrowing owls and their future developments in the area. There is no mention of the workflow or the volunteers so the information in the video is not exactly the same as the text on the webpage. In short, it seems to be an informational video that gives viewers a glimpse of the setting and the scientific programme.

The first image of this About Research page contains a burrowing owl standing out of the burrow (Figure 10). The main distinctive characteristic is that their nests and roosting life takes place on the ground, not in a tree cavity like other owl species. In addition, the position of the burrowing owl next to the rocks that form the entrance to the cave allows the navigator to imagine that this species of owl is not very tall or large, but rather small and rounded.

Figure 10. Image of Burrowing Owl from WBO Project

Later in the text we find a photograph of burrowing owl eggs laid inside the burrow under the ‘Digging Into Burrowing Owl Conservation’ section (Figure 11). This indicates that the cameras are also installed inside the burrow, providing information on

the breeding, nesting and roosting process. In the 'Burrow In' section, other photograph (Figure 12) of a fluffy burrowing owl chick being held between two hands, suggesting the small size of the newborn. This is the last image in this section. The section closes with the embedded YouTube video mentioned above. However, this is a particularly symbolic image. The owl's eggs represent the continuity of the species.

Figure 11. Burrowing Owl eggs from WBO Projects

The image also informs the citizen volunteers further regarding the species preservation. The colours used in the photograph are adapted to the brownish tones of the burrowing owl and the type of soil in which the burrows are made, which is usually a light-coloured soil, sandy terrain or even darker or reddish-brown burrows. It depends on the soil and the burrowing owl's adaptation for camouflage and protection. The only contrasting element is then the predominant greyish-white colour of the eggs and the burrowing owl chick who are born in their 'fluffy and buffy' stage of life with their eyes closed.

This image gives continuity to the close up of Figure 12, a burrowing owl chick, which is very recently born given its 'fluffy and buffy' stage of life with its eyes closed.

Figure 12. Burrowing Owl chick from WBO Project

In general, the main communicative function of the visual and multimodal elements is to provide detailed information, which gives the citizen a more accurate description of the project.

4. Discussion

This study set out to explore the ways in which scientific content is conveyed and communicated in online Citizen Science projects that require the participation of non-expert, diverse audiences. The examples examined for this study were 'Woodpecker Cavity Cam' and 'Wildwatch Burrowing Owl' both of them retrieved from the digital citizen science platform Zooniverse. The analytical procedures followed in the study involved the application of genre theory (Swales, 1990) but, specifically, Askehave and Nielsen's (2005) theoretical framework for the analysis of web-mediated genres (i.e., digital genres). This framework advocates the analysis of digital genres by focusing on two-dimensions, text as a genre and text as medium, hence the need to analyse web texts in the reading mode and the navigating mode. With regard to the first dimension, the aim was to identify the recurring linguistic resources and their communicative functions of texts representing citizen science discourse. As for the latter dimension, the analyses centred on the multimodal and hypertextual affordances of the web-texts selected for the study, in particular the hyperlinks and the images that are used along with the text. The case studies illustrate that the navigating mode permits the navigator to 'exploit the characteristics of the hypertext medium' (Askehave and Nielsen, 2005, p. 128) freeing it from the static nature of a printed text.

The first question in this study was to identify the type of language that characterises web-mediated CS projects and the communicative functions of the recurring linguistic resources strategies, by this means conducting an analysis of CS genre exemplars in the reading mode. According to Paltridge (2012, p.78), aspects such as the setting of the text, the focus and perspective of the text, the purpose of the text, the intended audience, the relationship between writers and readers, and the relationship

of the text with other texts generally have ‘an impact on what the writer writes, and the way they write it’. In the case of the ‘Woodpecker Cavity Cam’ project the observed results have shown that web-text forms of CS projects tend to focus on a set of goals or communicative purpose that are not realised by a wide range of linguistic complexities. Instead, plan language was used, also the case of online crowdfunding proposals, as reported by Pérez-Llantada (2021, 2023). The reason for this is that, through these CS projects, researchers are targeting at active and collaborative public, which explains the use of the use of plain language that at the same time makes content concise and direct (Luzón and Pérez-Llantada, 2022). Overall, the online CS project of ‘Woodpecker Cavity Cam’ on Zooniverse should be interpreted taking into account the contextual features of this digital genre. Due to the detailed information on red-headed woodpeckers and the workflows described in the text described by the research team, inviting citizen to participate, the project highlights the relationship between the scientific team (authors) and citizens (readers), based on citizen’s help for scientific knowledge. This emphasises Bonney et al. (2009)’s claim that CS projects can boost scientific research and favour scientific literacy among citizens. More specifically, the corpus analyses showed that the verbal strategies were simple but forward, wanting to make sure that the message was understood. In order to achieve this, although the textual explanation was characterised by a clear and plain use of the language, the information was supported by the use of images, that at times established a relationship of complementarity with the text (the verbal message), and at other times a relationship of concurrence with the verbal text message (e.g., the close up of the chick). In all cases, the images were mode immediate than the text for persuasive effects. Hyperlinking affordances also played an importance role in the projects. They invited the navigator to explore further content related to the text.

With regards language use, the empirical results showed that there is a recurrent use of the pronoun ‘you’, which means that there is an intention to create a closer relationship between author and reader, in the sense that the navigator feels addressed in the project and the possibilities of the reader to want to collaborate as a volunteer is augmented. Therefore, the use of this pronoun creates a relationship that aims to engage the audience in scientific research processes, in this case data classification processes. In the texts there was greater use of the object pronoun which is usually used to construct relationships through proximity and affinity. Furthermore, it can be said that the use of the coordinating conjunction ‘and’ is used more at phrase level than at sentence level, suggesting that simplicity is preferred over any linguistic (e.g., lexical, grammatical/syntactic) complexities that might slow down the process of understanding, and reduce the chances of prompting citizen’s collaboration. Therefore, it can be said that this feature is common in CS projects as they opt to use explicit language so that the amateur audience can get the essence of the message that the scientists want to convey which is to make them collaborate and help the scientists in the project. The style was also non formal, echoing the language of conversation, as described by Quaglio and Biber (2006), creating proximity with the citizens. From a rhetorical perspective, this type of text is more likely to use an engaging type of language that is easier to understand and more accessible, hence the tendency to use the coordinating conjunction at the phrase level rather than the sentence level. Fecher and Friesike’s (2014) claim that research should be based on transparency and accessibility.

With regard to second question of the study, it was found that both texts integrated multimodal elements such as images and photographs creating a predominant text-image complementary relationship (Jones and Hafner, 2012). The visual message (i.e. the images), though, was more immediate and topological than the verbal message.

For example, in the red-headed woodpecker project there is a graphic figure on the webpage that provides information that clarifies the entire process of the scientific research team in the project. The graphic figure itself might not be self-explanatory enough and the text alone might not be as comprehensive without the graphic. Furthermore, the text of this project subpage clarifies that 'This graphic provides an overview of the whole process […]' (WCC Project, Zooniverse), implying that the author of the text explicitly adds this graphic in order to give a better understanding of the role of volunteers in the whole scientific research process. Both elements thus combine and complement each other giving a broader understanding of the author's intention in the project and increasing the possibilities of citizen volunteers to collaborate in the scientific project. According to Jones and Hafner (2012), the predominant relationship between text and image in the red-headed woodpecker project is a relationship of concurrence because the 'messages are the same and reinforce each other' (p. 60). On the other hand, in the WBO project the predominant relationship between text and image is a relationship of complementary because each mode does not portray the exact information of the other mode; rather, it presents 'slightly different information, which "colours in" the details of the message in the other mode' (p. 61), specifically complementing information for content enhancement and persuasion purposes. In both cases, the use of images aims to create a persuasive appeal on the citizens, which is fundamental in online participatory projects. Additionally, the case studies have shown that the combination of text and images in both case studies are effective rhetorical strategies that serve to recontextualise specialised content for a non-specialist audience while at the same time making a persuasive appeal to citizens.

In response to the third research question, the function of hyperlinks, the YouTube video link in the WBO project can be classified as an externally hyperlinked

text. Its main communicative function is to enhance the content text creating an implied relationship or subtle association of exemplifying and illustrating content that is described in different ways (i.e., different modes). One possible interpretation of these findings is that, through the verbal-visual relationship, the web navigator finds different navigational paths to access content in different ways. With the complementary use of the visual mode and the text, greater engagement is achieved. The construction of a phatic relationship is reinforced by the overt environmental concern raised in the YouTube video content, whose narrator is a member of the scientific research team. The hyperlinks of the WCC Project, are also worth recalling her. Three of them took the web user to an internal link, and two of them took the web user to an external link. There were two external hyperlinks whose main function was to expand the content of the web text analysed. In terms of internal hyperlinks, the analysis of the two case studies has shown that there is a hypertextual structure where 'parts of the document are linked to other parts of the document or other documents on the internet […] based on relationships of associations' (p. 37). In this case the links took the navigator to the Researcher team subpage, and to the project homepage and the FAQ subpage respectively.

5. Conclusion

In conclusion, these exploratory findings show that language resources and rhetorical strategies such as multimodal features are key in Citizen Science projects, which is also the case of other digital genres (Luzón and Pérez-Llantada, 2022). This is important because CS projects are participatory, Open Science practices that, as the literature explains (Bartling and Friesike, 2014; Burgelman et al., 2019), aim to educate citizens in science and increase their scientific literacy. The genre exemplars of the present study illustrate how the genre or category of discourse representing citizen science communication ultimately targets a non-specialist and broad audience for seeking to obtain citizen's collaboration.

This exploratory study has several limitations. In this exploratory study the data set was relatively small to obtain conclusive results, and future research with larger data sets is necessary to corroborate the findings. Nonetheless, the generic patterns observed in this study suggest that a two-dimensional view of genres is particularly insightful to gain a better understanding of language and multimodality in online Citizen Science discourse.

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