Educating Future Popularizers of Science: Linguistic Insight for Scientists

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Abstract

Science popularization has become a vital aspect of doing scientific research. Numerous universities and research institutions require the scientists to present their findings not only to colleagues but to a wider, general audience, which often includes laymen. At times, research funding can depend on the success or failure of such presentations. However, the skills necessary to produce engaging popularizations are often left out when it comes to science education. This paper offers simple, practical solutions for producing written popular texts. The suggestions presented are based on linguistic analysis of current successful popular scientific publications and cover such areas as narrative descriptions of discoveries, incorporation of the multiple voices of the scientific community, creating a favorable and relatable image of science and its practitioners. The presentation highlights the similarity between the practices already familiar to professional or aspiring sciences (for example, construction of a laboratory report or a scientific article) and the abilities required to produce popularizations. The author proposes drawing on the already-existing writing skill set instead of introducing an approach which asks for a completely different point of view. The arguments presented are based on linguistic insights of Rom Harre, Michael Hoey, William Labov, Greg Myers, Michael Toolan, and many others. The author advocates for the inclusion of the popularizing skill set as part of science education curriculum.

1. Introduction

Science popularization has become a vital aspect of doing scientific research. However, the writing skills necessary to popularize scientific advancements are ordinarily not part of the science education curricula. Often, students themselves have to take the initiative and organize workshops to help eachother become successful not only in the laboratory but among the laymen as well. An example is University of Michigan's RELATE—a graduate-student-founded program that aims to promote science communication skills [1].

When it comes to developing specific skills for producing written popularizations, the advice can generally be found in numerous how-to manuals. Produced largely by professional scientists turned science writers, these guides often present very limited insight into language-related matters. They are mostly reduced to the discussion of vocabulary and the general guidelines on clarity. Such labels as "universal language" [2] or "lay language" [3] are designed to distinguish between the professional discourse of scientists and the everyday prose familiar to general audiences and inevitably create a juxtaposition where one kind of discourse becomes undesirable (professional scientific discourse) and another one is favored (everyday, layman's discourse). The features of the former, usually simplistically identified as passive voice and technical terminology or jargon, are to be replaced by a more audience-friendly language [4].

The language aspect of popular science, however, is more complex and has more to it than vocabulary and grammar. First of all, it is crucial to present scientific findings in a form of a story. To accomplish this task successfully, a popularizer needs to have at least a rudimentary knowledge of a narrative structure appropriate for popular science. Secondly, it is vital to present scientists as relatable characters. This is where the understanding of speech and though presentation plays an important role. Thirdly, a popularizer needs to realize that doing science and writing about it has a lot to do with fictionality—perhaps more than he/she expected.

Quite often, creating a popular account of research findings has been associated with an uncomfortable realization that the popularizers have to discard their former knowledge on communicating science since the skills acquired by writing for colleagues will become useless when addressing a lay audience. It has also been suggested that those scientists who venture into the field of popular writing must undergo drastic changes to their attitudes toward laymen [5]. Needless to say, such propositions can cause apprehension and negative attitudes towards popularizing one's findings.

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The methods outlined in the remainder of this paper, however, demonstrate that such drastic approaches are unnecessary. Professional scientific writing skills as well as analytical skills developed as a result of doing reseach can become a basis for the popularizing skill set.

2. The power of narrative

First of all, the idea that narrative technique is employed in fiction only and has to be specially acquired by those who do science is misguided. Narrative is a popular form of knowledge dissemination, no matter the kind of knowledge. In fact, some scholars suggest that it is the preferred method for humans to acquire and process new information [6]. What does this mean for a popularizer? You don't need to alter your thinking about your research or your discipline. You already have the storytelling skills; all that is left is polishing them so you can produce the right kind of narrative.

When writing popular science, the right kind of narrative means explanatory narrative—a narrative that presents the research from one particular point of view by placing the scientific concepts in a context familiar to a lay audience. As Reitsma notes, "A narrative … includes interpreted information" [7]. The interpretation introduced by a popularization eliminates the need to draw conclusions between the scientific concepts or events presented, thus creating a text that is easy to understand. The power of narrative is in its structure, which allows for both—the introduction of facts and the explanation and evaluation of their significance.

2.1. Narrative steps for a popular science text

Anyone who has written a lab report or published an article knows that there are specific steps to follow in order to produce an acceptable text. These steps are quite similar to what a lay reader expects from a well-told story. First of all, present your events sequence (just as in a report or a methods section of an article), and then proceed to explain and evaluate your material (just like in a discussion and a conclusion section of an article). Science students may be surprised to learn that this familiar organizational structure is similar to what linguist William Labov observed as a structural core of personal experience stories [8]. With little modification, Labov's structural model can be used to create simple and straightforward popular science narratives. In fact, many successful popularizers (think Brian Green, Michio Kaku, and Marcus du Sautoy) have already employed this technique.

The original Labovian approach suggests that narratives can be parsed into several sections that correspond to the following elements: Abstract (an optional brief summary of a narrative to come), Orientation (introduction of the characters and the setting of a narrative), Complication (the main body of a narrative), Evaluation (the speaker's assessment of a narrative), Result (the resolution of a narrative), and Coda (the element that transitions the speaker and the listener/reader from the past events of a narrative to the present). In addition to these structural elements, a popular science narrative should also contain the Explanation. This portion of a narrative supplies information that helps the reader understand the concept being discussed.

The Explanation is marked by the shift in tense from the past simple to the present simple. This change alters the focus of a narrative from the scientist/s to the reader. The Explanation is a likely location for reader engagement mechanisms—textual features that are explicitly referring to the reader and attracting his/her attention. These include reader pronouns ("you" is the most common), directives (asking the reader to do something), questions (not always rhetorical), and asides. Reader-enagament mechanisms can be used throughout a narrative, but they must be present in the Explanation.

2.2. Types of narratives

Michael Hoey's research [9] into textual patterns when applied to popular science reveals that there is a limited number of ways to present new developments in science. Most popular sicence narratives will align with the following types: Gap-in-Knowldge, Problem-Solution, and Goal-Achievement. The Gap-in-Knowledge pattern describes a story that starts out with an acknowledgement that a scientist does not know something. The narrative, therefore, informs the reader on how this gap is filled. The Problem-Solution narrative, contains the Complication that clearly identifies a problem that should be solved by the end of the narrative. The Goal-Achievement narrative sets a goal, which is reached by the end of the story.

It might be surprising to some, but the most popular pattern among the current bestselling authors (du Sautoy, Green, Kaku) is the one that showcases the initial lack of knowledge on the part of the scientist. One explanation for the popularity of this narrative pattern is the desire to make scientists into characters with whom a lay reader can find commonalities. Myers suggests that finding common

ground between the experts and the laymen is an important step towards the establishment of trust in the scientific community and in individuals who represent it [10]. Narrative is an excellent means of shaping scientists into trustworthy and relatable characters.

3. The power of personality

One of the easiest ways to make scientists into characters suitable for a popularization is to use the presentation of speech and thought (presented discourse) strategically. Presenting the speech of scientists does not always mean quoting. A popularizer may "invent" what a particular scientist says. It is especially effective to create explanations using presented discourse of scientists instead of narration (information that comes from the narrator).When quoting verbatim, it is good to choose quotes that showcase personality not only professional expertise. Including voices of the people close to the main character is also a viable strategy, as they can showcase the scientist as a private person. The bottom line for using presented discourse is to establish a degree of intimacy between the scientist/s whose research is being popularized and the reader. A good way to achive this is to use presentation of thought to introduce crucial information, for example, the main discovery of a narrative. Instead of providing a technical description of a discovery, imagine the thought process used to arrive at that conclusion and introduce it to the reader as thoughts of your main scientist-character.

4. The power of fiction

The previous section suggests that fictionality can be helpful in creating a successful popularization. In fact, fictionality is not alien to professional science as well [11]. Thought experiments and modeling so common among scientists are examples of fictionality. Extending the skills acquired to perform these tasks to writing popular science will yeld engaging popularizations.

A specific way to employ fictionality in popular science is to model or fictionalise your reader. The traditional mechanisms for including the reader in a text include the reader engagement techniques discussed above and a few others, all of which deal with covert representation of the reader. The fictionalized reader, on the other hand, is created through its own presented discourse and functions like any other character in a text. Successful popularizers use thought experiment techniques (imagining what a reader might say) in order to project a reader-character. One effective way of using presented discourse to fictionalize the reader is to employ hypothetical Direct Speech (DS) to enact possible reader reactions to explanations provided in the text. Quite often hypothetical DS of the reader forms dialogues either with the author or with other characters.

5. Conclusion

Being able to write about science for a lay audience has become an integral part of being a scientist for many practitioners. Research funding and acceptance of laboratory work may depend on how successful scientists are in communicating with the public. However, writing skills specific to popularization are generally not included as part of science curricula. The three simple steps briefly introduced above (narrative structure, characterization of scientists through presented discourse, and fictionalizing the reader) can be easily integrated into writing assignments for future scientists or science educators. All of these popularizing mechanisms are related to the skills and concepts commonly associated with professional science, which should allow for a seamless integration into science curricula.

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