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Popular Science as a Means of Emotional Engagement with the Scientific Community

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Abstract

This article explores a debate (and its origins) which is taking place around the issue of science popularization. Although the participants are all describing popularization in various ways, the heart is in what makes a good popularization. The notion of this has changed from the 19th century view, which called for a simple and easy-to-understand text, to a more modern view, which suggests a good popularization engages the reader emotionally. This discussion might also be seen in a context of a more profound debate of science experts versus general public and what science and scientific knowledge mean to each group. The exploration of this relationship suggests a shift in the role lay public plays in science.

Keywords: Science popularization; reader engagement; emotional engagement; knowledge theory

1. Introduction

In the modern world, there is a clear line between the lay public and the scientific community. However, the division has not always been there, and science as a social category has not always been regarded as a domain of specialized knowledge inaccessible to average citizens. Current research on popularization of science often cites examples of active public involvement in the 18th and the first half of the 19th centuries, when sciences were accessible to lay persons and, in fact, attracted many amateurs who ended up making scientific contributions (see for example, Bensaude-Vincent, 2001; Lightman, 2000; Topham 2000). Bensaude-Vincent (2001: 102) calls them “enlightened amateurs.” She points out that “Amateurs considered themselves to be members of the republic of science, a large international community or network of people who investigated nature and reported their results to each other.” From the second half of the 19th century, however, science became separated from the public. There are different ways of explaining and evaluating this phenomenon.

2. Materials and Methods

The suggestions and conclusions expressed in this article are a result of an extensive interdisciplinary literature review on the subjects of history of popularization, philosophy of science, linguistics, and knowledge theory. The sections that follow introduce a synthesis of the materials examined.

3. Findings

3.1. Mind the gap

Some believe that the gap between the scientists and the public was a result of deliberate and detrimental actions of a small group of scientists led by T.H. Huxley (see, for example, Lightman 2000). As Lightman (2000: 101) sees it, scientists of the 1890s tried to secularize science by separating it from what he calls “elements that previously had connected public and scientific culture, including anthropomorphic, anthropocentric, teleological and ethical views of nature.” Lightman (2000: 101) proposes that the scientists of the second half of the 19th century set out to present themselves as the only authorities on secular natural knowledge. As such, they favored “detached language, heavily spiced with complex scientific terms” designed to ensure the exclusion of non-experts from the discourse (Lightman 2000: 101). Lightman (2000) following Myers (1990) proposes that such use of language disguised the narrativity of scientific writing thus presenting scientific results as entirely objective and untainted by human interference.

Topham (2000), similarly to Lightman (2000) suggests that the separation of the public from the scientific community that occurred in the 19th century was the result of deliberate boundary work on the part of the scientists, but, unlike Lightman, he does not mention any one scientist specifically. Instead, Topham (2000: 560) attributes the change to “epistemological and rhetorical shifts” that resulted in emphasis on expertise instead of experience and positioned scientific discoveries “as the preserve of scientific ‘genius’” rather than as an activity open to anyone. Topham (2000: 559-560) also sees advancements in scientific instrumentation as a contributing factor to the creation of passive lay public. As

Lightman (2000), Topham (2000) sees the separation as artificial and as a result of deliberate efforts on the part of professional scientists.

Bensaude-Vincent (2001) explains the gap between the lay public and professional scientists differently. First of all, she regards the gap not as a static notion of separation but as a process of alienation (105). Bensaude-Vincent (2001: 100) suggests that the separation between the scientists and the public is not an unnatural and negative occurrence, but “a necessary ingredient of our [western] notion of science.” The alienation between the two groups, however, is unnatural and harmful. She suggests that the separation of professional and popular science happened in the 19th century, but the alienation between the scientists and the public did not become pronounced until the 20th.

3.2. Popularization of Science as a Result of the Gap

Once the access to professional science was denied to the public, popularization of science became more popular than ever. However, those who produced the texts for popular consumption remained keenly aware of the boundaries between the academy and the lay readers. As a result, popular science evolved into a genre that emphasized connections between everyday, familiar objects and occurrences and scientific phenomena. Keen (2014) calls popular science of the 19th century “familiar science.” Popular science became the science of the home. It was very different from the “real” science that was to be conducted by professional scientists in their laboratories. Keene’s (2014) material suggests the creation of a means to secure the separation of professional and popular science—one is done in a laboratory with the help of specialized apparatus, while the other can take place in a kitchen and uses everyday household objects. This phenomenon produced a kind of paradox where the scientists were keen to explain their actions to the public, but in doing so distanced their audiences from the “real” work. It was common to regard such approach to popularization as a translation—a method of popularization that later became known as the dominant model.

3.3. A Different Model of Popularization

Many studies of the history of popular scientific publications demonstrate that

public interest in science remained strong throughout the years of the professionalization of the scientific community. The public, it seems, kept resisting the image of the scientifically ignorant masses assigned to it. It is only logical that sooner or later a different view of popular science, the one that recognized and acknowledged public input, would emerge. The perception of the role of popularizations as translations was eventually overcome. The works of Myers (1990, 2003) and Bucchi (1998) played an important role in changing how popular science was regarded and how it should be written.

The popularizers of the 19th and early 20th century, guided by the dominant model approach, focused mainly on the transmission of facts. The assumption that their audience was ignorant and lacked the tools to evaluate and connect with the knowledge transmitted did not allow the authors to explore the full potential of the public. As Myers (2003) and Laslo, Baram-Tsabari, and Lewenstein (2011) suggest, knowledge of scientific facts is not the same as public engagement with or interest in science. For the scientists, knowledge is primarily a cognitive category, but for the public it can also be experiential and emotional, residing in the communicative dimension rather than entirely in the cognitive one. Myers (2003: 269) points

out that the public's strength is in the ability "to connect the abstractions of scientific knowledge to lived experience."

3.4. Scientists' Knowledge vs. Public's Knowledge: the Possible Reason for the Gap

Those who write about the discrepancies between the public's and the scientific community's understanding of scientific knowledge (see, for example, Calsamiglia, 2003; Laslo et al., 2011; Myers, 2003) outline the differences in perspectives but do not necessarily provide explanations for these variations. I believe that the underlying cause of the gap or the separation between the scientific community and the public is the fact that they rely on different knowledge types. In addition, it is possible that each sees its preferred knowledge type as superior to and separate from the others.

Among the many knowledge-type taxonomies (see, for example, Bloom 1956, Anderson and Krathwohl 2001, and Krathwohl's 2002), Yang's (2003) holistic theory of knowledge appears the most applicable for the current topic. Yang (2003) provides an update on the four commonly recognized knowledge types (factual, conceptual, procedural, and meta-cognitive) and demonstrates that they function not independently of each other but as a whole. Yang (2003, p. 108-109) suggests the following facets of knowledge: explicit, implicit, and emancipatory. Explicit knowledge is the "cognitive component of knowledge that represents one's understanding about reality" (108). Implicit knowledge is "personal, content-specific familiarity" and "usually comes from ... one's behavior, action, and accumulated experience" (109). Emancipatory knowledge is affective knowledge. It is "value-laden" and "is indicated by feeling and emotions people have in relation to the objects and situations around them" (109). Yang (2003: 108) argues that people learn "not only through mental correspondence but also by direct personal involvement [and] ... through...emotions." He suggests that the three facets or types of knowledge are inseparable and that measuring just one of them provides false impressions about expertise or intelligence (111-113).

Yang's (2003) epistemological framework helps explain the less than stellar performance of the lay public in surveys designed to check for knowledge of scientific facts (such surveys are mentioned in, for example, Myers, 2003: 268 and Laslo et al., 2011: 848). It is most likely that the surveys are measuring explicit knowledge, while the public is more likely to possess implicit and emancipatory knowledge when it comes to science. Explicit knowledge is more likely to be the primary knowledge domain of the scientific community (as de Jong and Ferguson-Hessler 1996 show), and in trying to communicate with the public and to assess the public's understanding of science the surveys are possibly disregarding the other two knowledge facets. This is a strong contributing factor to the dissociation between the scientists and the public.

If the public connects with science and its practitioners on an emotional level, why shouldn't popularizations reflect this preference?

4. Discussion

4.1. Popularizations as a Matter of Interaction and Emotional Engagement

By the end of the 20th century and beginning of the 21st, popularizations started to be recognized as points of interaction between the scientists and the public. With that, the way the public is seen by the scientific community has also begun to shift. The public is once

again regarded by the scientists and the popularizers as a participant in scientific affairs (see, for example, Calsamiglia, 2003; Laslo et al., 2011; Luzon, 2013; Moirand, 2003; Myers 2010; Supper 2014). However, the role of a lay person has changed from what it was in the 18th and 19th centuries. Lay people today participate in science not by producing it but by experiencing it, evaluating it, and engaging with it emotionally. The public of the past used to engage with science in terms of explicit knowledge; the public of today relies more heavily on implicit and emancipatory knowledge of science. Yang's (2003) holistic theory of knowledge can find evidential support in recent linguistic studies of popular science texts.

The studies conducted in the early 2000s tend to use corpora of newspaper and magazine articles discussing scientific issues. Their analyses of interactivity are based on textual features; they examine what Thompson (2001: 60) recognizes as the "reader-in-the-text"—"the reader as enacted by the writer." Later studies (Laslo et al., 2011; Luzon, 2013; Myers, 2010) deal with corpora representing what Laslo et al. label "new media"—articles on the web and science blogs, which include interactive commentary features available to readers. This allows the researchers to examine not only the interactive mechanisms present in the main text (the article or the blog post) but also the responses from real readers who engage with each other as well as with the original author. Such public participation creates, in the words of Laslo et al. (2011, p. 849) a "redrawing of the boundaries between the spheres of production and consumption" of science.

The studies of interactivity (including Laslo et al. 2011) demonstrate that the types of knowledge about science the public exhibits align with the implicit and emancipatory knowledge facets proposed by Yang (2003). Based on Yang's (2003) definitions and characteristics of each knowledge facet, implicit and emancipatory knowledge facets are not able to generate the kind of knowledge that the scientific community recognizes as scientific knowledge—theoretical, objective knowledge of nature. Implicit and emancipatory knowledge facets are reactionary or processing domains in connection to explicit knowledge. Thus I propose that the modern public is involved in science but does not significantly impact its production. Unlike Laslo et al. (2011), I would regard a lay person's interaction with a blog as evidence of engaging implicit and/or emancipatory knowledge, but I would not see this interaction as contributing to the production of explicit knowledge (creation of new scientific knowledge). In my opinion, the public's involvement contributes to the discussion and evaluation of the already produced knowledge. This is especially evident in analyses of electronic media. As Laslo et al. (2011: 865) themselves point out, online media with their interactive component open up "the public's primary source of information about science and technology as a space for debate and deliberation."

Textual interactions created via reader-engagement mechanisms are directed at simulating the public's experience with science through implicit and emancipatory knowledge channels. Such interactions mark a shift in the relationship between the scientific community and the public. The interactional elements in popular science texts, I suggest, are not cognitively empty shells designed to hold reader's attention, but potentially significant elements that activate implicit and emancipatory knowledge facets. By including these elements, popular science texts acknowledge and foster the public's interpretation and understanding of science. Just like the amateur scientists of the past centuries, the modern public is engaging with science once again. However, this time, the interaction is initiated not by the laypeople (as it was with amateur scientists) but by the science writers who often are also members of the scientific community. The technological progress and narrow specialization of sciences no longer allow for the majority of the general public to take part in the actual experiments and

engage through the use of explicit knowledge. The interaction between the scientists and lay persons has moved from the laboratory to the printed or online page where the public engages its emancipatory knowledge and shares its reactions to the implicit knowledge produced by the scientific community.

4.2. Text-based Popularizations and Emotional Engagement

Turney (2004) argues that written texts are capable of creating deep emotional responses to scientific writing. He suggests, using an example of Woolfson's book *Life without Genes* (2000), that by using metaphors popular science writing can simulate sensory experience of scientific phenomena that do not allow easy sensory perception (Supper 2014 makes the same argument for sonification.). Turney (2004) calls this rhetorical technique "the abstract sublime." His analysis of Woolfson's text draws a connection between textual and sensory engagement techniques of popularizations. Luzon (2013) also shows how a combination of textual and sensory engagement mechanisms creates an interactive experience for the reader. Luzon (2013: 437, 442-443) reveals that blogs employ all of the prototypical reader engagement techniques (for a list see Hyland 2009, 2010; Thompson 2012), which represent textual mechanisms of engagement. In addition, they also add links to external sites that provide visuals and audio—sensory techniques.

Luzon's (2013) observations reinforce Myers' (2003) proposition that popularizations are not limited to texts. At the same time, texts are not limited in the ways they can engage the readers. Turney's (2004) example and analyses performed by Laslo et al. (2011) and Luzon (2013) suggest concrete techniques writers can employ to help their readers not only know science but also connect with it on an emotional level. Making texts interactive and engaging the readers' emotions emerge as successful strategies for reader involvement. Metaphors appear to be one of the most often employed mechanisms of connecting the reader with the scientific community.

Thus there is a strong argument to be made for the inclusion of metaphors among textual features of reader engagement. Caracciolo (2013) is one of the strong proponents of this view on metaphors. Drawing on an example of fictional scientific writing (Ian McEwan's novel *Saturday*) Caracciolo (2013) suggests that readers can engage with a text on an emotional level through phenomenological metaphors—metaphors that reflect the experiences and emotions of a focalizing character. Caracciolo (2013, p. 73) calls this "imaginative engagement."

While metaphors have been explored as examples of emotional engagement, they are clearly not the only means to establish such a connection between the readers and a text. Luzon (2013) suggests that direct communication with experts, as is offered through blogs, for example, is a way to connect with science on a personal and emotional level

5. Concluding Remarks

Review of recent research of science popularization trends suggests that in the 21st century those who study and produce popular science texts realized and utilized the importance of public participation in science. This participation, however, is different from the public involvement with science production common in the 18th and the 19th centuries. The modern public participates not through working side by side with scientists but through emotional and

personal involvement with science. The studies surveyed above suggest that such engagement could be achieved in text-based popularizations. In texts, emotional engagement could be encouraged through use of specific interactive devices usually described as reader engagement mechanism. Until now, these mechanisms did not include metaphors. However, recent research points out the importance of certain types of metaphors in creating emotional engagement between the readers and the subject of the text. Metaphors can facilitate the public's use of implicit and emancipatory knowledge facets as defined by Yang's (2003) holistic theory of knowledge to establish a connection with the world of science.

It is possible that through the fostering of the emotional connection of the public with the scientific community, the gap between the two could be narrowed

Conflict of Interest

The author has not declared any conflicts of interest.

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