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Genre knowledge: a metacognitive approach to exploring document practices in science

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Abstract

Introduction. This paper examines genre knowledge and its influence on scientists' interactions with various document types, or genres, throughout the scientific process.

Method. The paper reviews genre theory, including its applications in prior research within library and information science. Then, it presents a scenario involving a molecular biologist, based on findings from science and technology studies.

Analysis. The analysis traces the biologist's activities within the scenario, outlining the creation and use of various genres during data collection, analysis and reporting.

Results. A research agenda based on genre knowledge is proposed to help scholars and practitioners in library and information science better understand and support scientists' interactions with genres.

Conclusion. The paper advocates for studying genre knowledge to further develop theoretical and practical insights into scientists' document practices. This approach bridges cognitive and sociocultural perspectives on information interactions, and may clarify how emerging scientists acquire these skills.

Introduction

What if seemingly mundane documents are crucial to science? This paper explores the significance of genres in the scientific process. It contributes to library and information science by proposing a research agenda that investigates why scientists interact with genres. Regardless of their disciplines, scientists – from astronomers to zoologists – must interact with documents as part of their professional activities.

Genre knowledge is an individual's metacognitive understanding of how and when to use different types of documents, also known as *genres* (Berkenkotter and Huckin, 1995; Tardy, 2009). Genre knowledge is a form of situated cognition embedded in disciplinary ways of knowing and doing. Scientists engage with various genres to conduct their work; however, library and information science predominantly focusses on the scientific products held in libraries (e.g., journal articles and data sets). This paper argues that additional genres, such as manuals, notebooks, proposals and standards, play important roles in the making of science and deserve scholarly and professional attention. Although this paper focuses on science, genre knowledge is relevant to other professional and everyday contexts (e.g., Andersen, 2017; Reiff and Bawarshi, 2016; Spilka, 1993). The knowledge, abilities and skills involved in creating and using genres are of interest in this paper.

Budd (2001) explains that epistemological positions significantly influence how library and information science scholars and practitioners think of their work. This paper adopts a *constructivist* approach, which portrays science as an *epistemic culture* that shapes and is shaped by scientists (Knorr-Cetina, 1999). Constructivism posits that scientific knowledge is the product of scientists' practices within their socio-material contexts (Hacking, 1999; Knorr-Cetina, 1981; Kuhn, 1962). These practices bring together assemblages of people, technology, methods, models, theories and numerous other epistemic devices necessary for carrying out science (Pickering, 1995). Frohmann (2004) argues that these practices also involve the ways scientists create and use documents. Constructivism challenges the notion that documents only serve as carriers of facts or representations of the world, a dominant epistemic view in library and information science (Day, 2001). Conceptualising knowledge as something scientists create, rather than as an ideal and unified abstraction, necessitates studying the processes by which scientists generate, validate and communicate facts (Rouse, 1996). This perspective reconsiders the traditional focus on the products of science, emphasising instead the integral role of reading and writing, broadly understood, throughout the scientific process.

Given the importance of documents to science, a number of questions arise, including:

- What genres do scientists interact with?
- What tasks do scientists apply these genres to?
- How do emerging scientists learn to recognise, create, use and apply various genres?

This paper argues that genre knowledge provides an approach to addressing these and other questions concerning scientists' information interactions. To outline this research agenda, I review genre theory and the concept of genre knowledge. I also connect genre knowledge with existing work in library and information science. Drawing on the science and technology studies literature, I provide a scenario that describes some of the genres involved in laboratory work. This scenario also illustrates how genre knowledge mediates the production of scientific knowledge. I propose that studying genre knowledge would further develop theoretical and practical understandings of scientists' document practices. This includes the role of genre knowledge in individuals' transitions from newcomers to emerging scientists. I conclude by offering suggestions for future enquiries.

Genre

A *genre* is a type of document, such as a patent, report or textbook, characterised by its content, form and communicative function (Bawarshi and Reiff, 2010; Devitt, 2004). While this paper focuses on genres of textual documents, future work could investigate other types of communication with which scientists interact, such as gestures or visual representations (e.g., Coopmans et al., 2014; Fogarty-Bourget et al., 2019; Kostelnick and Hassett, 2003). Recognising the characteristics of content, form and function enables individuals to coordinate their activities through the appropriate application of various genres.

Each genre provides content intended for one or more tasks. Therefore, applying the appropriate genre to a task is crucial for the efficiency and effectiveness of work (Spinuzzi, 2003). Genres are typified by their repeated applications within a social context. Miller (1984, p. 163) explains, '*genre refers to a conventional category of discourse based in large-scale typification of rhetorical action; as action, it acquires meaning from situation and from the social context in which that situation arose*'. Similarly, Devitt (2004, p. 31) describes genres as '*a nexus between an individual's actions and socially defined context*'. In this way, genre theory conceptually bridges cognitive (i.e., individualistic) and sociocultural perspectives, explaining that members of a discipline recognise recurring tasks and the necessary genres to address the information needs associated with those tasks (cf. Byström, 2007; Freund, 2008). Genre theory has been applied in library and information science to a wide range of contexts (e.g., Andersen, 2008; Andersen, 2015; Brannon et al., 2022; Foscari, 2013; Gorichanaz, 2017; McKenzie and Davies, 2012). By analysing the form, content and function of genres, researchers can better understand disciplinary practices, including why individuals in specific situations interact with certain documents and not others (Freund, 2013; Huvila, 2019).

Creativity and imagination are important in the scientific process; however, an individual can only push the form, content or function of a genre so far before the genre becomes unrecognisable to others. This is not to suggest that genres are fixed. They are, instead, '*stable-enough-for-now*' (Schryer, 1993, p. 229). Diachronic genre analyses, such as the studies by Bazerman (1988) and Gross et al. (2002) on scientific journal articles, describe how genres can change over time. Miller and Kelly (2017) also provide theoretical insights into the *emergence* and *evolution* of genres. They argue, '*Because genres are dynamic sites of tension between stability and change, they are also sites of inventive potential*' (Miller and Kelly, 2017, p. v).

Similar to how musicians are expected to have a repertoire, scientists must interact with a number of genres (Berkenkotter and Huckin, 1995; Swales, 2004). Scholars have conceptualised the genres associated with a social group as *chains* (Swales, 2004), *ecologies* (Spinuzzi and Zachry, 2000), *networks* (Tardy, 2009), *repertoires* (Orlikowski and Yates, 1994), *sets* (Devitt, 1991) and *systems* (Bazerman, 1994). Together, this body of work recognises the interconnected nature of genres, where members of social groups interact with multiple genres to perform recurring tasks.

Genre theory considers the variety of genres and their purposes within a given context. Dodson et al. (2024) and Freund et al. (2005), for example, identify significant correlations between genres and tasks in engineering. This indicates that genres function as specialised tools, employed in specific situations. However, the library and information science literature concerning scientists has predominantly focussed on a single genre: the journal article. While journal articles are crucial for communicating scientific findings, other genres, such as datasheets, manuals and lab notebooks, also mediate scientific work. Information behaviour studies and scientometric analyses that focus on journal articles are valuable; however, these works offer a limited perspective, because scientists interact with more than journal articles. Broadening the focus to other genres will provide insights into the making of science. Shankar (2009), for instance, highlights the role of lab notebooks in establishing evidence of the rigour and trustworthiness of scientific knowledge claims.

Scenario

The science and technology studies literature has described *science in action*, particularly through ethnographic studies of the places and sites of science (see Knorr-Cetina (2001) for an overview of laboratory studies, and Bowker (1994) and Kohler (2002) for research on field-based science). Latour and Woolgar (1979) portrayed laboratories as *inscription machines*, where scientists generate knowledge through cycles of document creation and use. Their case study details the work of molecular biologists, which I reinterpret through a genre theory lens in the following scenario:

Rui collects a tissue sample from a mouse that has been treated with a test substance, prepares the tissue for analysis and inputs the sample into a mass spectrometer. This instrument transforms the sample into a spectrum of light waves, which represents the chemical composition of the tissue. Rui then compares this spectrum to those of previously collected samples from the experimental and control groups using specialised data analysis software. Rui interprets the statistical results to determine the efficacy of the treatment. Rui records each procedure and result in a lab notebook. These notes will be essential when Rui writes the lab report.

Documents and associated practices are crucial *infrastructure* that supports science (Shankar et al., 2017). Tracing the document practices for operating this inscription machine reveals the reading and writing that Rui must undertake. Rui's information interactions can be nonlinear, as the relationships between genres are complex and often form rhizomatic connections (Spinuzzi, 2015). Such understandings have been theorised in the science and technology studies literature in ways that articulate the work performed by documents (Frohmann, 2004; Knorr-Cetina, 1981; Latour and Woolgar, 1979). In library and information science, Day (2021) frames Latour's (1996) conceptualisation of information within the concept of *documentality* (cf. Buckland, 2014; Frohmann, 2013). This framework views '*documentary evidence and meaning as constructed through an indexical relationship between documents and the real, using genre conventions, social practices, technologies and techniques, and other epistemic devices*' (Day, 2021, p. 7). Documentality underscores the work that documents do and the agency they hold (Frohmann, 2009). Scientists must have the skills and abilities to engage with various genres to conduct their daily tasks. This raises several questions. For example, how did Rui learn to perform the following tasks:

- Configuring (and troubleshooting) the mass spectrometer using its manual
- Using the data analysis software by referring to its documentation
- Recording the experiment's procedures and findings in a lab notebook, and so forth?

Scientists' document practices warrant further investigation. In addition to building upon existing research (e.g., Hammarfelt, 2022; Huvila et al., 2022; Palmer et al., 2007; Shankar, 2007; Trace, 2017), these enquiries could leverage the concept of genre knowledge.

Genre knowledge

Genre knowledge refers to an individual's metacognitive understanding of the form, content and function of the genres created and used in their discipline (Artemeva and Fox, 2010; Devitt, 2007; Tardy, 2009). As alluded to in the scenario, a genre-aware individual understands what genres are at their disposal, how to create and use those genres and when to apply genres to different tasks.

Internalising document practices is a necessary part of becoming a scientist; however, scholars and teachers have identified numerous challenges in teaching and learning genre knowledge. Developing the abilities to recognise, create, use and apply genres is a lengthy and complex process for learners (Artemeva, 2008; Shankar, 2009; Winsor, 2001). Individuals often continue to develop these skills throughout their careers (Artemeva and Fox, 2010; Devitt, 2007; Winsor, 2003). The

time required for developing genre knowledge is understandable, as Beaufort (2007), Berkenkotter and Huckin (1995) and Tardy (2009) have argued that genre knowledge depends on other types of knowledge, including subject-matter expertise. There are longstanding and ongoing debates about whether genre knowledge can be taught through explicit instruction or only through authentic hands-on trial and error (Dias et al., 1999; Dias and Paré, 2000; Tardy, 2009).

The genre knowledge and labour involved in building, maintaining and operating inscription machines is often obscured in the communication of scientific knowledge (Knorr-Cetina, 1981; Latour, 1987). This concealment hides the underlying incentives, values and cultural, social and technical processes that influence science (Daston and Galison, 2021; Haraway, 1997; Longino, 2002). As a result, journal articles often present evidence as *natural*, *objective* and *self-evident* facts, as if they were discovered rather than created. This presentation necessitates contextualisation and interpretation. When the products of science are accepted without scrutiny, the labour of producing them becomes invisible and risks being devalued.

A research agenda focussed on genre knowledge could help library and information science scholars and practitioners better understand i) how scientists use documents in their work, and ii) how students, as emerging scientists, learn to interact with documents. Understanding how and why scientists interact with genres will enable library and information professionals to better serve their needs by designing and providing tailored services. For example, librarians could use the genre-task maps by Dodson et al. (2024) and Freund et al. (2005) in information literacy instruction to teach students the appropriate use of different genres. This research agenda could address the questions posed in the Introduction by pursuing the following objectives to:

- Develop and validate instruments to assess scientists' genre knowledge.
- Investigate the tasks in which scientists create and use genres, identifying patterns and differences across disciplines.
- Examine the processes through which emerging scientists acquire genre knowledge, including formal education, mentorship and practical experience.
- Assess the effectiveness of information literacy instruction in fostering genre knowledge among emerging scientists, identifying best practices and areas for further development.

Summary

This paper advocates for the concept of genre knowledge and considers its implications for studying scientists. The paper explored the development and uptake of document practices among emerging scientists. Genre knowledge is particularly useful in this context as it bridges cognitive and sociocultural framings of information interactions, thus contributing to understandings of how individuals are enculturated into science. By bringing together previous work on genre and the sociology of scientific knowledge, the paper points to future work that investigates open research questions requiring empirical and theoretical attention to the role of document practices in the creation of scientific knowledge.

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