UNDISCIPLINED THINKING FACILITATES ACCESSIBLE WRITING: A RESPONSE TO DOUBLEDAY AND CONNELL

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In their recent paper, Doubleday and Connell [1] touch upon the importance of good scientific writing in promoting interdisciplinary research, noting that 'If difficult writing impedes communication within disciplines, it will certainly impede communication across disciplines'. The authors suggest that researchers who write in an accessible style will have their work glimpsed by academics in neighboring disciplinary fields or silos with these glimpses contributing to the innovation and discovery that are central to science. Doubleday and Connell note that learning to write accessibly requires a constant appreciation of style and its different forms. Here we draw upon our experiences in interdisciplinary research to explore the idea that such collaborations may facilitate undisciplined thinking and

development of writing styles. Specifically, we propose that working across disciplinary lines necessarily exposes researchers to new academic languages and cultures, highlights the limitations of their own, and encourages the development of new composite communication styles more accessible to readers of all disciplines.

A key feature of an academic discipline is the language used, which can be difficult for an outsider of the speech community to understand or interpret [2-7]. An easily-recognized difficulty that arises from these different languages is the use of words or phrases that exist in the mother-tongue of one discipline but not another; either because the concepts are not common to the two (that is, a reliance on discipline-specific jargon; e.g. the use of 'turf algae' without the description of 'it's like a lawn in the ocean' by a biologist communicating with an economist as occurred in our experience detailed in Box 1), or because a common concept is referred to differently in the two disciplinary languages (e.g. terms used to describe a particular statistical procedure) [2, 6, 7]. A similar issue, albeit one more difficult to recognize, is where a key word or phrase found in both languages has dual, discipline-dependent meanings (e.g. 'catchment' is understood to mean different things by social and physical scientists) [2].

Disciplines also have specific epistemic cultures surrounding communication style that influence basic features of journal articles. The conventions adopted by each discipline can be perplexing to an outsider from another culture, possibly even to the extent that the message presented is undermined. For example, one feature that varies between disciplines is how authors refer to themselves. To an academic from a discipline in which first-person prose is uncommon (or actively discouraged), a writing style in which researchers write themselves into journal articles and consider the influence of their own biases may appear

unprofessional or self-indulgent [3, 5, 7] (for an example see Box 1). Another key feature of articles that can influence perception and is largely determined by culture is their length; a short environmental science article that outlines key points briefly may be perceived to be lacking in detail to a researcher from a social science-based culture in which philosophical arguments are laid out in a more discursive fashion with generous use of examples and flowing, descriptive language [4, 7].

Effective interdisciplinary collaboration, therefore, requires researchers to develop the skills necessary to identify and then overcome such linguistic and cultural barriers. In practical terms, researchers firstly need to consume and examine communication styles used in different disciplines. Together, the researchers then need to work to take apart and identify the linguistic and cultural building blocks they instinctively use [2, 4, 5]. This process can highlight each researcher's own disciplinary limitations (e.g. the use of formal language or a cultural expectation for highly technical descriptions) and, potentially, reveal techniques for how such limitations have been overcome in other disciplines (e.g. simplification of language or use of relatable examples to supplement complex ideas) [2, 8]. Finally, researchers need to produce manuscripts explicitly targeted to a diverse, interdisciplinary audience. To achieve the accessible writing style required to communicate with such an audience, it is likely researchers will instinctively and creatively borrow from each represented discipline.

This proposed need for creativity in interdisciplinary communication brings us back to the piece by Doubleday and Connell. While Doubleday and Connell propose that accessible writing can promote interdisciplinary communication by increasing the accessibility of both neighboring and distant research [1], we have highlighted here that collaboration which aims to overcome the barriers between disciplines can itself drive the development of accessible

writing styles. Although we presented the communication approaches used in individual disciplines as being largely homogenous, increasingly there is room within disciplines for inventiveness and opportunities to diverge from the dominant linguistic and cultural features such that writing becomes undisciplined [7, 9]. Consequently, we advocate researchers develop the skills associated with interdisciplinary research as they will likely be associated with a writing style that enables their papers to be read, understood, and remembered – regardless of the discipline to which the writer or reader belongs.

Box 1. Our interdisciplinary collaboration

One way in which academics from some cultures highlight their understanding of a topic is by inserting themselves in the story, a practice which is typically not used in our disciplines. We have, however, seen how this technique can be employed effectively when writing about interdisciplinary collaboration (see, for example, [3-6]), and are tentatively adopting it here (albeit in a self-contained Box separated from the main text). Recently we – Falkenberg and Tubb – worked together in a university department where interdisciplinary research was promoted, providing an opportunity to combine our discipline-specific perspectives; Falkenberg is a marine biologist while Tubb is an economist. However, as has been explored in other case studies, understanding each other's languages and cultures, let alone developing a new undisciplined language and culture, was more complex than initially conceived. Consequently, the main output from our collaboration to date is a review paper highlighting where gaps in the field exist and how future interdisciplinary collaborations could fill these [10]. We hope our developing literacy in each other's languages and cultures will enhance our creativity, in both thinking and writing.

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