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**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

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

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

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

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

57

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

70

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

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

83

84

85 **Box 1. Our interdisciplinary collaboration**

86 One way in which academics from some cultures highlight their understanding of a topic is
87 by inserting themselves in the story, a practice which is typically not used in our disciplines.
88 We have, however, seen how this technique can be employed effectively when writing about
89 interdisciplinary collaboration (see, for example, [3-6]), and are tentatively adopting it here
90 (albeit in a self-contained Box separated from the main text). Recently we – Falkenberg and
91 Tubb – worked together in a university department where interdisciplinary research was
92 promoted, providing an opportunity to combine our discipline-specific perspectives;
93 Falkenberg is a marine biologist while Tubb is an economist. However, as has been explored
94 in other case studies, understanding each other’s languages and cultures, let alone developing
95 a new undisciplined language and culture, was more complex than initially conceived.
96 Consequently, the main output from our collaboration to date is a review paper highlighting
97 where gaps in the field exist and how future interdisciplinary collaborations could fill these
98 [10]. We hope our developing literacy in each other’s languages and cultures will enhance
99 our creativity, in both thinking and writing.

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