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Information pairing

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Abstract

A topological study of information pairing patterns in scientific or technical writing helps to understand the origin of common errors of accuracy and precision, and also how to correct or avoid them altogether.

1 Introduction

Communication in scientific or technical documents involves information pairs such as 'question–answer', 'problem–solution', or 'title–content'. Such pairs consist of (a) the information that is *intended* to be transmitted, and (b) the information that is *actually* delivered. The correspondence between these two parts typically has two requirements[1], *accuracy* and *precision* (Perdicoúlis, 2012), for which specific guidance is often issued by instructors and editors. Practice also depends on the academic preparation and competence of the authors.

Information pairing is important for keeping *uncertainty* in check: we do not want to introduce *new* uncertainty while creating a document — the uncertainty we may already have up to the moment of writing is uncomfortable enough, so we need to transmit that knowledge as faithfully as possible.

2 Topological study

Let us explore a number of information pairing patterns in a visual, 'topological' study of relative positioning — from τόπος [Gk], place, *locus* [L]. The important loci are: (a) the circular boundary of scope, which represents the information *intended* to be transmitted; this circle, together with the 'crosshair' (+) focal point determine the *accuracy* of the transmitted information; (b) the consistency of the fill, which determines the *precision* of the transmitted information.

[1] Accuracy and precision can be invoked simultaneously by the term *exactness* (Perdicoúlis, 2012)

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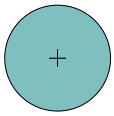
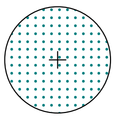
2.1 Exact



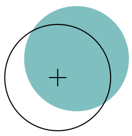
The perfectly transmitted information is *exact*: (a) *accurate*, providing full coverage of the circle, around the 'crosshair' focal point, and without over-spilling, and also (b) *precise*, at a suitable degree of detail, resolution, or information density — not too dense, not too rare.

2.2 Dilution



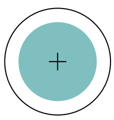
Sometimes information is 'vague' or 'imprecise', which refers to the quality of information as 'high granularity' or 'low resolution'. This quality of information can be represented as a *dilution* effect: the transmitted information is 'not solid' enough to be used any further, so its value as 'knowledge' is limited. This effect is produced, for instance, when the author does not know enough (e.g. lack of study, or genuine scarcity of information), or does not write well.

2.3 Deviation



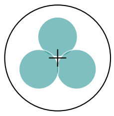
It is possible to have good knowledge on a subject, but mis-understand the question. This mis-match between question and answer appears as a 'shift' or 'deviation' from what was intended to be communicated. This is practically a shift of scope: instead of placing our attention where it was asked, we place it somewhere else. Errors such as title–content mis-match are classic deviations, whether in chapters or sections, or the whole document.

2.4 Omission



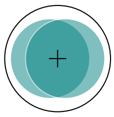
Sometimes we have good knowledge on a subject, but do not appreciate the full extent of the question — or our 'good-quality' knowledge is limited. In such cases, the answer does not provide full coverage — in other words, it has omissions: it is delivered at a 'narrower scope', and is less in amount. Omissions may occur at any part of the circle (subject or question), including the cases of 'dilution' (§ 2.2) or fragmentation (§ 2.5).

2.5 Fragmentation



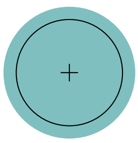
A less-than-complete answer — i.e. with omissions (§ 2.4) — may have some further deficiency: fragmentation. This usually indicates a not-fully elaborated argument, in which the 'pieces do not connect'. This creates *uncertainty* in the sense of 'what are the relations between the provided pieces of information?' Causes of fragmentation or an incoherent argument can be long sentences, which are difficult to construct and verify, and/ or a messy, loose, or invisible document structure.

2.6 Redundancy



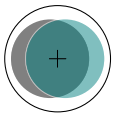
Besides fragmentation (§ 2.5) and more generally omissions (§ 2.4), a not-well elaborated argument may also present redundancy (§ 2.6). Redundancy also creates *uncertainty* in the sense of 'are the two pieces exactly the same? If not, what are the differences between them?' Internal pointers, better known as 'cross-references', easily avoid duplication of information.

2.7 Overkill



For not risking omissions (§ 2.4), some people add more information than necessary — in scope and/ or amount — and this creates an 'overkill'. 'Overkill' sometimes intends to impress the readership of the author's vast knowledge, but there is little space for 'impressions' in scientific or technical writing: 'overkill' technically contains 'information not requested', and introduces uncertainty of the kind 'is this relevant? and why?'.

2.8 Inconsistency



Poorly elaborated arguments may present conflicting facts, and this creates inconsistency. This effect can also be produced, for instance, by mis-use of terms (which may un-intentionally point to something inappropriate or contradictory), by title–content mis-match, or by redundancy (e.g. repetitions with slight differences).

3 Discussion

Information transmits what is 'learned', often accompanied by facts and indications of their significance (Perdicoúlis, 2013a). To be trustable, information must meet challenges such as dealing with uncertainty — or aiming to 'be sure' — and complexity — or aiming to 'be at the appropriate aggregation level' (Perdicoúlis, 2011, pp.24–25). This demand creates certain obligations of 'scientific rigour' to the issuers of information in publications (Perdicoúlis, 2012), which are applicable to complete documents as much as to their constituents such as arguments, ideas, or observations and measurements. While the focus of scientific rigour in publications traditionally refers to numerical information (Perdicoúlis, 2013b), it is important to give due attention to the information in text form — from a full document, down to its chapters or sections, paragraphs, and phrases.

This pairing analysis between the intended and transmitted information constitutes no theory: it is merely a topological study, with the use of illustrations. It helps to understand the origin of common errors of accuracy and precision in scientific or technical writing, and how to correct or avoid them — at least in principle. For further reading in the broader scientific literature, accuracy is classified under the heading of *systematic error*, while precision under the heading of *random error* (Watts and Halliwell, 1996).

4 Challenges

The classic endeavour 'how to write well' remains as a concern of personal performance, and is associated to a 'learned practice' — i.e. following principles and receiving feedback. From the perspective of the instructor, the challenge remains *how to teach* 'how to write well'. Instructors must have mastered that themselves, obviously, before putting their didactics (i.e. teaching) or pedagogy (i.e. broader and/ or deeper guidance) into practice.

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