

RECONTEXTUALISATION, RESEMIOTISATION AND THEIR ANALYSIS IN TERMS OF AN FDG-BASED FRAMEWORK

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Abstract

“Recontextualisation” is the process whereby content that has been given expression in one context (the “source” context) is subsequently reused in a different context (the “destination” context). It is often accompanied by “resemiotisation”, the process whereby content is lifted from one text (the “antecedent” text, situated in the source context) and recast in a modified form during the production of a subsequent text (the “derivative” text, situated in the destination context). The aim of the present paper is to evaluate the adequacy of FDG, incorporating an extended model of context (EMC), as a basis for the analysis of the process of recontextualisation and of the accompanying resemiotisation. The study is based on the analysis of a corpus of texts consisting of one antecedent and six derivative texts, all drawn from the field of science communication. The texts are subjected to a contextual analysis in terms of the categories afforded by an analytical framework based on the EMC. From these contextual analyses, the differences between the source context and each of the six destination contexts are identified. These differences encapsulate the changes that constitute the essence of recontextualisation. In addition, each of the texts is analysed in terms of a three-tier framework based as far as possible on FDG. The resulting analyses are then compared, in order to identify the changes that constitute the essence of resemiotisation. Finally, the relationship between the recontextualisation and resemiotisation is discussed. From the point of view of evaluating the linguistic models employed, it transpires that the categories offered by the EMC appear to be viable as units for the analysis of recontextualisation. As for the analysis of resemiotisation, it turns out that a theoretical foundation for a substantial part of this, though not all, can be supplied by current FDG.

Keywords: Context; Functional Discourse Grammar; Recontextualisation; Resemiotisation; Science Communication; Science Popularisation.

1. Introduction

1.1. Aim

One of the most attractive characteristics of FDG, as proposed by Hengeveld and Mackenzie (2008), is that it provides for an explicit treatment of context, and of the interrelationship between context and the form and function of language. The handling of context in FDG has been discussed by several authors, including Connolly (2007a,b), who has proposed an extended model of context (EMC) that offers a more detailed treatment of contextual factors.

In Connolly (this volume) it is suggested that the EMC is applicable not only to FDG as a grammatical model but also to the wider model of verbal interaction of which FDG is intended to form part. A subset of the EMC appears to be sufficient for the grammatical model. However, in the present paper we shall be dealing with certain discourse-level phenomena, and we shall therefore draw as necessary on the whole of the EMC.

The central issue to be addressed in this paper lies in an aspect of the handling of context that has not so far been discussed in the FDG literature, namely the treatment of “recontextualisation”. This is the process whereby content that has been given expression in one context (to be known here as the “source” context) is subsequently reused and made manifest in a different context (to be termed the “destination” context).

When content is recontextualised, it is generally reformulated or re-expressed in the process. When this happens, the recontextualisation is said to be accompanied by “resemiotisation”. For instance, the content of an article in an academic journal may be recontextualised, and recast in a simpler form, within a newspaper report aimed at a more general public. If so, then the recasting of the *text* constitutes the resemiotisation, while the movement of the content from one *context* to another constitutes the recontextualisation.

In the example just given, the journal article constitutes what will here be called the “antecedent text” (or simply the “antecedent”), while the textbook and the newspaper report will be termed “derivative texts” (or simply “derivatives”). Accordingly, the context surrounding the antecedent text constitutes the source context, while that surrounding a derivative text constitutes the respective destination context.

The aim of the present paper is to evaluate the adequacy of FDG, in conjunction with the EMC, as a basis for the analysis and description of the process of recontextualisation and of the resemiotisation that may accompany it. The categories afforded by the EMC will be employed as the basic elements of contextual analysis, and hence the study will serve to test their capacity to function as appropriate units for the analysis of context.

1.2. *Corpus*

The present study is based on a corpus of seven texts drawn from the field of science communication. The text that serves as our starting-point is as follows:

- (1) A paper reporting on a study that indicated a link between (i) artificial food colourings and additives and (ii) hyperactivity in young children. This was published in the peer-reviewed journal *The Lancet* by McCann et al. (2007), which will here be regarded as constituting the antecedent text which supplies the source context.

The recontextualisation of the content of this paper will be analysed on the basis of the following six texts, all of which are derivatives of (1):

- (2) (a) A press-release in the form of *EurekAlert* (2007), issued in time to allow media reports to appear on the same date as the publication of the article, but under an embargo designed to prevent findings being released in advance of official publication.

- (b) An article in the *Times* (2007), a quality newspaper, reporting and commenting on McCann et al. (2007).
- (c) An article in the middle-market newspaper, the *Daily Mail*, written by Poulter (2007), reporting and commenting on McCann et al. (2007).
- (d) An article in the popular newspaper *The Mirror*, authored by Cook (2007), reporting and commenting on McCann et al. (2007).
- (e) An article appearing the day following the publication of Poulter (2007), in which Poulter and Brogan (2007) launched a *Daily Mail* campaign against food additives.
- (f) A news item about McCann et al.'s study, written by Minkel (2007), in the popular science magazine *Scientific American*.

It is not being claimed that these texts constitute a statistically representative corpus. Rather, they may be regarded as furnishing the basis of a case study. As such, they will serve their intended purpose of acting as a test-bed for the evaluation of FDG, incorporating the EMC, as a viable framework for the analysis of recontextualisation and of the concomitant resemiotisation.

The choice of corpus was determined by two main factors. Firstly, the texts were chosen with the aim of providing variety in relation to (i) context and (ii) style. Secondly, each text in the corpus can be accessed on-line, so that the data can be readily verified by others.

A remark is also called for in relation to the choice of a specific publication as furnishing the source context for the analysis of recontextualisation. The paper by McCann et al. (2007) is undoubtedly not the first communications by its authors on the topic concerned. Rather, as Hilgartner (1990: 528) indicates, in science communication there is a typically progression “downstream” from early communications, such as conversations within a research laboratory, via formal publication, to subsequent treatments in textbooks and the mass media. However, in some cases it is possible to pick out, within this progression, an identifiable publication that clearly serves as the source for other identifiable communications downstream of it. The paper by McCann et al. (2007) is a case in point.

As will be apparent, our corpus provides for a study of the particular area of science communication that is concerned with the popularisation of science. For an investigation of the area which deals with science education, see Connolly (forthcoming).

1.3. Method

The method to be used for analysing recontextualisation consists in:

- (3) (a) Subjecting each text in the corpus to a contextual analysis in terms of the categories afforded by an analytical framework to be presented in 2.2 below, thus producing a systematic description of the context of each text.
- (b) Systematically comparing these contextual descriptions, in order to identify the contextual differences between the source and each of the various destination contexts.
- (c) Treating such systematic comparisons as analyses of the contextual changes which constitute the essence of recontextualisation.

As for the analysis of resemiotisation, the ways in which a derivative text could differ linguistically from its antecedent are endless. Consequently, in order to keep the investigation within manageable bounds, we shall confine ourselves to certain features that previous work has found to be characteristic of scientific discourse, with a view to discovering the extent to which these survive the recontextualisation into the more popularised milieu of the mass media.

The method to be used for analysing resemiotisation consists in:

- (4) (a) Analysing each of the texts in the corpus in terms of a three-tier framework to be described in 3.2 below. The three tiers in question relate respectively to the lexical, grammatical and discourse aspects of the texts concerned.
- (b) Systematically comparing these descriptions, and also the respective composition of the texts, in order to identify the changes that constitute the essence of resemiotisation.

Where possible, quantitative comparisons will be carried out in respect of the relative frequency-of-occurrence of the selected features in the antecedent text and in each of the derivatives in the corpus. These comparisons will reveal whether, and to what extent, the texts within each antecedent-derivative pair differ in respect of the selected characteristics of technical scientific writing. Consideration will also be given to the question of how such textual differences relate to the contextual differences between the pairs of documents involved.

2. Recontextualisation

2.1. *Analysing recontextualisation*

The fullest theoretical account of recontextualisation appears to be that presented by Linell (1998, 2003), who starts out from the premise (1998: 86) that all discourse is “contextualised” (i.e. it is invariably constructed within some actual context), and goes on to say (ibid.) that “when pieces of discourse are taken out of their original context, and used ... in a new context” they are thereby “recontextualised”. He then proceeds to define recontextualisation as “the dynamic transfer-and-transformation of something from one discourse/text in context ... to another” (1998: 154). Transfer and transformation are described by Sarangi (1998: 310) as the two “dimensions” of recontextualisation. See also van Dijk (2008: 105).

In the academic study of science popularisation several authors echo the view that recontextualisation entails transformation. Hilgartner (1990: 526) avers that it is “impossible to restate a claim without transforming it in some way”, while Holliman and Scanlon (2009: 254) state that the reporting of scientific advances in the media offers only a “partial, mediated view of new developments in science”. As Miller (1999: 206-207) points out, such mediation may necessitate simplification, and it may also involve the conversion of scientific advances into news stories.

The popularisation of science is described by Fuller (1998: 36) as a “transformative act of making science accessible”: An act of recontextualisation and resemiotisation that involves “repackaging” science so as to conform to the discursive conventions of “more overtly social and political texts”. Such an analysis strongly

suggests that the discourse of popular science is ideologically different from that of academic science.

2.2. Analytical framework

For the purposes of the present study, an analytical framework based on the Extended Model of Context (EMC) proposed in Connolly (2007a, this volume) is to be employed. In the EMC, distinctions are drawn between the following subtypes of context:

- (5) (a) Discoursal and situational context.
- (b) Socio-cultural and physical context (these being subdivisions of situational context).
- (c) Broader and narrower context (these being subdivisions both of discoursal context and of situational context).

It is proposed that the sub-classification of context presented in (5) should form the basis of the analytical framework for the purposes of the present study. As will be apparent, the major categories of the framework are as follows:

- (6) (a) Narrower discoursal context.
- (b) Broader discoursal context.
- (c) Narrower physical context.
- (d) Broader physical context.
- (e) Narrower socio-cultural context.
- (f) Broader socio-cultural context.

However, (6a), which comprises discourse-internal co-text, will be disregarded, since we are here concerned only with entire texts.

(The EMC also incorporates a distinction between linguistic and non-linguistic context. Within multimodal documents, the non-linguistic components are contextual in relation to the linguistic text. However, they also constitute elements of the multimodal discourse. For this reason, they will be dealt with as part of the analysis of resemiotisation, below.)

In fact, our analytical framework needs to be more detailed than that implied in (6), in order to provide a clear place for dealing with considerations such as authorship, audience, social status, cultural norms and ideology, which have been treated in the science communication literature as being important issues; see, for instance, Myers (1989: 3-4), Bucchi (1996: 376), Hornig Priest (2009: 232-234) and Sharma and Anderson (2009: 1266).

The broader discoursal context is analysed in terms of two subcategories, as follows:

- (7) Broader discoursal context:
 - (a) Inter-text.
 - (b) Genre.

The inter-text of a document is supplied by the other texts on which it explicitly draws, while its analysis in relation to genre serves to assign it (if possible) to a particular discourse-type, which may or may not be the same as those instantiated by its inter-text.

The narrower physical context is subclassified in terms of four categories, as follows:

- (8) Narrower physical context:
 - (a) Author(s): Their identity, if known.
 - (b) Addressee(s): Their identity, if known.
 - (c) Date when the text was published.
 - (d) Place (specified as narrowly as is feasible and relevant) where the text was published.

As for the broader physical context, this is analysed in terms of three subcategories, as follows:

- (9) Broader physical context:
 - (a) Authorship: The geographical region (here, the country), if known, where the author(s) were based.
 - (b) Publication: The geographical region (here, the country), if known, or the virtual environment (such as the World-wide Web) where the publication took place.
 - (c) Target readership: The geographical region, if known, where the intended addressees were based.

Moving on to the socio-cultural context, the narrower aspect of this is analysed in terms of five subcategories, as follows:

- (10) Narrower socio-cultural context:
 - (a) Authors: Considered as members of particular social groupings, such as the academic community.
 - (b) Target addressees: Considered as members of particular social groupings.
 - (c) Relative status of author and target addressees.
 - (d) Occasion: The type of event or scene. In the present paper, the occasion will be one either of formal (i.e. peer-reviewed) publication or of informal publication.
 - (e) Purpose.

In relation to (10c), the work of Myers (1989: 1-7, 28-30) is pertinent. Myers offers an interesting characterisation of difference in power-relationships between author and audience in different genres of science-related writing. He claims that in textbooks, for example, authors write on behalf of the scientific community, and are therefore cast in a more powerful role than the reader, whereas in a research article, the reader is cast as representing the scientific community and in this respect occupies a more powerful position than the author(s), who may therefore be described as “deferent” to it. In popular science, however, authors tend to write in such a way as to foster solidarity with their readers, casting both parties as inhabiting the world outside of professional science, and thus implying a reasonably equal power-relationship between themselves and their audience (though not, of course, an equal level of prior knowledge).

As for the broader socio-cultural context, this covers both social groupings and cultural aspects. The social groupings of greatest relevance include those to which the authors and the addressees belong, but may also encompass the social groupings

affected by the content of the text(s) concerned. As for the cultural aspects of greatest relevance, these are analysed in terms of three subcategories (11b-d) based on Goodman (1992: 29-34):

- (11) Broader socio-cultural context:
- (a) Social groupings of greatest relevance.
 - (b) Knowledge and beliefs: The relevant cognitive background of the authors, shared with (or at least acknowledged by) the target audience.
 - (c) Norms: The conventions associated with the relevant discourse-type.
 - (d) Values, including ideology, which is described in terms of two factors:
 - (i) Political ideology.
 - (ii) Scientific ideology.

With regard to ideology, some authors align themselves with a political standpoint, such as environmentalism (the “green” movement), while others do not. Moreover, various ideological positions are possible in relation to science; see Gregory and Miller (1998: 52-80). In scientific research papers, an “enquiry-oriented” approach is adopted, whereby science is viewed as an endeavour in which conclusions are inescapably provisional and (in principle) always open to falsification. However, in textbooks and press-reports, science is often presented as authoritative, as though it were always settled and uncontested. Still other science-related writings adopt an anti-science view, and attack its methods (perhaps on ethical grounds) or the consequences of scientific advances (such as chemical pollution). It is important that such issues should be accorded a place within the contextual analysis of science communication, given their importance in the sociology of science; see, for instance, Irwin (2009).

2.3. Analysis of recontextualisation in the corpus

Applying the method of recontextualisation analysis proposed in 1.3 and 2.2 above to the corpus of data presented in 1.2 yields results which may be summarised in the following manner.

2.3.1. Broader discursive context

The antecedent text by McCann et al. (2007) belongs to the genre of scientific research articles, and its inter-text consists of exclusively academic references. In contrast, *EurekAlert* (2007) belongs to the genre of press-releases, and the remaining derivatives to those of newspaper or magazine articles.

The inter-text of the press-release is supplied by academic publications (including the antecedent). The press-release, together with (indirectly) the antecedent, then supply the inter-text for the derivatives, excepting the *Scientific American* article, which was probably based directly on the antecedent text. In addition, Poulter (2007) and Cook (2007) draw on a document issued by the Food Standards Agency (a UK government department) and also on statements by relevant spokespersons. So do Poulter and Brogan (2007), who additionally draw on statements by the contemporaneous Prime Minister and on previous articles in the *Daily Mail*.

2.3.2. *Narrower physical context*

McCann et al. were the authors of the antecedent text, and may perhaps have had some involvement in writing the press-release, whereas the authors of the remaining texts were all journalists. The addressees comprised (fairly obviously) the readers of the various publications within the corpus.

The antecedent text was published in London and on-line in early September 2007. The derivatives were published either more-or-less to coincide with it or shortly afterwards. They, similarly, were published in London and on-line, except for Minkel (2007), which was published in New York.

2.3.3. *Broader physical context*

Although the authorship and publication of the antecedent text were UK-based, its target readership was international; and the same can also be said of the press-release. However, the newspaper articles were aimed mainly at a British readership. On the other hand, the target readership of the American-based magazine article was international.

2.3.4. *Narrower socio-cultural context*

The authors of the antecedent text were members of the medical science research community, and the target addressees were fellow professionals, to whom the authors were “deferent” (in the sense explained earlier). However, although whoever wrote the press-release would also have been a member of the university community, the target readership consisted in members of the journalistic profession, with neither side really being “deferent” to the other. As for the rest of the derivatives, the authors were all members of the journalistic community. The newspaper articles were targeted towards individuals from different market-segments within the general public of the UK.

When the antecedent text appeared, the occasion was one of formal publication (in the sense explained above), and the purpose was to disseminate research results. However, all the other texts underwent an informal type of publication. Nevertheless, most of them shared the same the purpose of publicising research results, though in the newspaper articles, additional aims were in evidence. Cook (2007) and Poulter (2007) set out to report not only the findings themselves but also reactions to these, while *Times* (2007) was clearly intended to issue a call to action by the food manufacturing industry in the light of the alarming research results. Poulter and Brogan (2007) went still further, seeking to inaugurate a campaign to ban food additives. No real “deference” was shown in the media reporting.

2.3.5. *Broader socio-cultural context*

Groupings involved in or affected by the work reported in the antecedent text included universities and other research establishments, relevant government departments, the

health service, the food industry and the general public. However, in relation to the press-release, it is the universities along with media companies that were most directly relevant. As for the newspaper articles, the most relevant groupings were the publishing organisations involved, together with the socio-economic categories to which their readers belong, and also (as with the antecedent) the relevant government departments, the health service, the food industry and the general public. Furthermore, when quotations were used from spokespersons representing special interest groups, the latter also constituted relevant groupings.

The antecedent text was produced and consumed in the context of existing scholarship in medical science. Indeed, to some degree, the same is true of all the derivative texts, too, but of course, these were produced with a particular awareness of the new findings by McCann et al.

The authors of the antecedent text were governed by the norms of scientific method, ethical experimentation and peer-reviewed publication. However, in the derivatives, the norms were particularly those of journalism, which include:

- (12) (a) Respect for embargo arrangements.
- (b) Balance, which involves giving a hearing to both sides of an argument; cf. Mellor (2009: 209). This often involves quoting spokespersons from either side of an issue, and is especially evident in the articles by Poulter (2007) and Cook (2007).

By way of exception to (12b), Poulter and Brogan's campaigning piece was one-sided, as was inevitable, given its purpose.

In terms of political ideology the antecedent text was unaligned, while in terms of scientific ideology it was enquiry-oriented. The press-release and magazine article were similar. On the other hand, the newspaper articles all took the view of science as being authoritative, and furthermore, they were all characterised by a "green" ideology that includes a desire for the elimination of toxic chemicals. In this respect, *Times* (2007) and Poulter (2007) were relatively non-belligerent, whereas Cook (2007) was more assertive, and Poulter and Brogan were aggressive.

3. Resemiotisation

3.1. Analysing resemiotisation

The term "resemiotisation" is defined by Scollon (2005: 473) as "the transformation of meaning from one semiotic form to another". In order to arrive at a useful method of analysing resemiotisation in science-related texts, it will be helpful to focus on those textual properties that existing research has found to be characteristic of scientific writing. This will provide us with the opportunity of seeing whether those properties are confined to academic-scientific prose or whether they are also carried over into non-academic science-related writings.

Let us begin with vocabulary. Scientific texts have been described as being characterised by a specialist, technical lexicon; cf. Halliday and Martin (1993: 3). Furthermore, Chalmers (2009: 73) states that academic scientific texts are written in an objective manner and are worded in such a way as to remove reference to the author's personal involvement in the work reported. Moreover, within the body of scientific reports, Wollman-Bonilla (2000: 48) notes a tendency to avoid (i) referring to

individuals, (ii) personification and (iii) colloquial language. However, according to Parkinson and Adendorff (2004: 388-389), popular science texts tend to be less technical in terms of vocabulary.

Halliday (2004b: 162, 168-169) also characterises scientific texts as being lexically dense, containing a relatively high proportion of lexical words (as opposed to grammatical words). However, Wollman-Bonilla (2000: 46) states that lexical density is more a property of academic science than of school science.

Gülich (2003: 241-248) identifies different types of verbal procedure that scientific experts may employ in order to illustrate technical concepts, in order to aid comprehension. The procedures concerned all involve, in some way, the device of “concretisation”, i.e. the “rewording [of] abstract information in a non-abstract manner”. They include the use of metaphorical language (encompassing not only actual metaphors but also comparisons and analogies), the provision of everyday examples and the description of scenarios (concrete situations or events that can be imagined by the audience).

With regard to grammar, the use of the passive voice (often agentless) in scientific writing, along with the impersonal style that tends to accompany the use of the passive, is reported by numerous authors, for instance Myers (1989: 3). On the other hand, according to Parkinson and Adendorff (2004: 381, 388), in popular science texts, individual humans are much more likely to be mentioned, while the passive voice tends to be avoided.

Another widely reported feature is the tendency to employ relatively elaborate nominal expressions; see for instance Myers (1989: 3). Halliday (2004a: 34) offers examples of elaborate nominals such as “glass crack growth rate”. Some of the nouns used in these expressions (for instance, the noun “growth”) are derived from verbs and can therefore be described as nominalisations. Nevertheless, according to Parkinson and Adendorff (2004: 389), there is a tendency to avoid nominalisations in popularisations.

A further feature, noted by Myers (2003: 266) and Roland (2009: 4), is the use of “hedging” devices, such as the modal auxiliary verb “may”. The advantage of such devices is that they provide a means to avoid expressing unwarranted certainty about scientific findings. See further Hunston (2013: 625).

At the discourse level, according to Myers (2003: 266), particular types of science-related texts are characterised by different rhetorical structures. For instance, research articles are associated with an “introduction-methods-results-discussion” (IMRD) structure.

Locke (1992: 13) points out that academic scientific discourse is an exercise in persuading others to accept one’s conclusions, and that from this perspective, the use of empirical evidence functions as a powerful rhetorical tool. However, science popularisations tend to concentrate on the conclusions of scientific investigations rather than the actual evidence presented, and thus rely for their persuasiveness on authority rather than directly on evidence cf. Sharma and Anderson (2003: 10-11, 22).

Finally, Sharma and Anderson (2003: 10) note the importance of visual communication in the form of graphs, charts and maps; see also Tang (2013: 22). This echoes Lemke’s claim (1998: 87-91) that multimodality is an inherent and fundamental property of scientific discourse.

3.2. Analytical framework

In the light of the foregoing, resemiotisation is analysed (within the present study) in terms of the categories specified below. The categories are grouped in terms of the following three-tier framework:

- (13) (a) Lexical analysis.
- (b) Grammatical analysis.
- (c) Discourse analysis, focusing on:
 - (i) Rhetoric.
 - (ii) Use of non-linguistic, in addition to linguistic, modes of communication.

Where it makes sense to do so, the results of the analysis will be presented in quantitative terms.

The lexical analysis of a text will determine:

- (14) (a) Lexical density: The number of lexical words as a percentage of the total number of words.
- (b) Nominal density: The number of nouns as a percentage of the total number of lexical words.
- (c) Technical density: The number of technical words as a percentage of the total number of lexical words.
- (d) Hedging density: The number of words used for hedging purposes as a percentage of the total number of words.

The lexical analysis will also record whether and, if so, how often:

- (15) (a) Reference is made to the scientist or team involved in the work.
- (b) Reference is made to other individuals or teams.
- (c) Personification is used.
- (d) Concretisation (e.g. metaphor) is used.
- (e) Emotive words are used.
- (f) Colloquial words are used.

The grammatical analysis will determine:

- (16) (a) Passive density: The number of passive verbal elements as a percentage of the total number of verbal elements.
- (b) Prevalence of agentless passives: The number of passive verbal elements with no overtly expressed agent as a percentage of the total number of passive verbal elements.
- (c) Overall grammatical complexity: The number of clauses divided by the total number of sentences.
- (d) Nominal elaboration: The number of words within noun-headed phrases divided by the total number of noun-headed phrases. (In order to avoid double counting, only noun headed phrases that are not embedded within other noun-headed phrases will be counted. Thus, for example, the noun-headed phrase “the size of the sample” contains the noun-headed phrase ‘the sample’ embedded within it. Hence, “the sample” would not be counted in its own right, but would simply be regarded as a component of the larger phrase, which would itself be counted.)

At the discourse level, the analysis will record:

- (17) (a) The overall rhetorical structure of the text.
 (b) The rhetorical strategy (dependence on evidence or on authority).
 (c) The number of occurrences of non-linguistic modes, namely:
 (i) Diagrams.
 (ii) Charts.
 (iii) Tables.
 (iv) Equations.

An important question concerns the extent to which the analytical framework just presented is supported by the theory of FDG. In relation to the lexical analysis, our category of “lexical word” may be described in FDG terms as a morphosyntactic word realising at least one lexeme, and “noun” is a lexical word class; see Hengeveld and Mackenzie (2008: 400-401). “Hedges” are recognised in Hengeveld and Mackenzie (2008: 111), while the notion of “reference” is fundamental in FDG; see Hengeveld and Mackenzie (2008: 15, 88). On the other hand, lexemes are not subdivided according to (non-)technical domain, (in)formality or emotiveness, though the affective aspect of language is recognised in Hengeveld and Mackenzie (2008: 8).

With regard to the grammatical analysis, FDG provides an apparatus to deal with passives and agents or “actors”; see Hengeveld and Mackenzie (2008: 182-207, 324-331). Clauses, too, are recognised in FDG; see Hengeveld and Mackenzie (2008: 16). Sentences, on the other hand, play “very little part” in the theory, though their availability as a category in the analysis of the written language (as in the present study) is acknowledged. Noun-headed phrases, however, are accommodated in Hengeveld and Mackenzie (2008: 376).

As for discourse, this is not handled comprehensively by current FDG. Consequently, the rhetorical and mode-orientated analyses cannot be FDG-based.

3.3. Analysis of resemiotisation in the corpus

Next, let us apply the method of resemiotisation analysis proposed in 3.2 to the texts in our corpus. The outcomes are summarised in Tables 1 and 2.

Table 1: Resemiotisation analysis relating to McCann et al. (2007) and its press coverage:
Lexical and grammatical aspects

	McCann et al.	<i>Eurek-Alert</i>	<i>Times</i>	Poulter	Cook	Poulter & Brogan	Minkel
Lexical Density							
Total lexical words	2221	255	240	572	165	450	49
Total words	4042	458	469	1117	246	911	83
Percentage	54.9	55.7	51.2	51.2	67.1	49.4	59.0
Nominal Density							
Total nouns	1415	149	124	340	110	255	29
Total lexical words	2221	255	240	572	165	450	49
Percentage	63.7	58.4	51.7	59.4	66.7	56.7	59.2

Technical Density							
Total technical words	208	28	16	37	22	16	3
Total lexical words	2221	255	240	572	165	450	49
Percentage	9.4	11.0	6.7	6.5	13.3	3.6	6.1
Hedging Density							
Total hedging words	2	5	1	8	1	1	0
Total words	4042	458	469	1117	246	911	83
Percentage	0.0	1.1	0.2	0.7	0.4	0.1	0.0
Reference to							
Scientists involved	23	3	1	2	3	1	0
Other individuals/teams	23	0	0	6	2	11	0
Tropes							
Personification	0	0	0	0	0	0	0
Concretisation	0	0	2	3	0	0	0
Relaxed							
Emotive	0	0	1	5	0	2	0
Colloquial	0	0	0	3	0	2	3
Passive Density							
Agentless passive	101	12	8	33	3	8	2
Agentive passive	8	2	3	2	0	3	0
Total verbal elements	338	33	75	153	31	117	12
Percentage passive	32.2	42.4	14.7	22.9	9.7	9.4	16.7
Prevalence Agentless	92.7	85.7	72.7	94.3	100.0	72.7	100.0
Grammatical Complexity							
Total clauses	338	33	75	153	31	117	12
Total sentences	156	17	23	54	15	40	3
Clauses per sentence	2.2	1.9	3.3	2.8	2.1	2.9	4.0
Nominal Elaboration							
Total words in nominals	2917	359	355	671	191	430	57
Total nominals	699	29	69	178	47	128	11
Words per nominal	4.2	12.4	5.1	3.8	4.1	3.4	5.2

Table 2: Resemiotisation analysis relating to McCann et al. (2007) and its press coverage:
Discourse aspects

	McCann et al.	<i>Eurek-Alert</i>	<i>Times</i>	Poulter	Cook	Poulter & Brogan	Minkel
Rhetoric							
Structure	IMRD	Plain	Plain	Plain	Plain	Plain	Plain
Strategy-base	Evidence	Evidence	Authority	Authority	Authority	Authority	Evidence
Mode							
Total diagrams	2	0	0	0	0	0	0
Total charts	4	0	0	0	0	0	0
Total tables	4	0	0	0	0	0	0

Total equations	28	0	0	0	0	0	0
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Note that the figures in these tables relate only to the running natural-language text, and exclude any textual annotations within graphical items.

Let us begin with lexical considerations. The lexical density of the antecedent text is 54.9%, while that of all the derivative texts lies within 10% of this figure, except for Cook's (2007) report in *The Mirror* (67.1%). Such a high percentage in a popular-newspaper article is quite surprising. These results suggest that not only academic scientific texts but also popularisations have a reasonably high lexical density.

As for nominal density, that of the antecedent text is 63.7%, while that of most of the derivatives lies within 10% of this, the exception being the *Times* (2007) report (51.7%). Again we have a surprising result, with a lower nominal density in the quality newspaper report than in the articles in the middle-market *Daily Mail* by Poulter (2007) and Poulter and Brogan (2007), namely 59.4% and 56.7% respectively, while the report in *The Mirror* displays an even higher nominal density (66.7%). Again, these results suggest that not only academic scientific texts but also popularisations have a reasonably high nominal density.

The measurement of technical density involved confronting the problem that there is no sharp distinction between technical and non-technical words; cf. Unsworth (1998: 204). This necessitated formulating clear criteria for discriminating between the two classes of words concerned. For the purposes of the present study, a word was classed as "technical" if it belonged to any of the following categories:

- (18) (a) Scientific terms for substances, e.g. "additive", "carmoisine".
 (b) Scientific terms from biology, e.g. "genotype", "ingest".
 (c) Scientific terms for medical conditions or procedures, e.g. "hyperactivity", "diagnosis".
 (d) Technical terms relating to experimental procedures, e.g. "randomisation", "protocol".

Even where such terms have passed into popular use (for example, "diagnosis"), they are still counted as 'technical' here, provided that they are still being used in their scientific sense.

On this basis, the technical density of the antecedent text turns out to be 9.4%. The press-release is very similar in this respect (11.0%), while most of the remaining derivatives lie within the range 3.6%-6.7%. However, the highest percentage is exhibited, very surprisingly, by the report in *The Mirror* (13.3%). These results, overall, certainly do not lend unequivocal support Parkinson and Adendorff's (2004: 388-389) claim about popularisations showing less technicality.

Hedging is not a feature of the texts analysed here, *pace* Myers (2003: 266) and Roland (2009: 4). The hedging density of the antecedent text is 0.0%, while among the derivatives, the highest hedging density is only 1.1%, which is attested in the *EurekaAlert* (2007) press-release.

Reference to the scientists involved in the experiment is made on 23 occasions in the antecedent text. This is a higher number than might have been expected in the light of Chalmers (2009: 73). However, in the derivative texts the number of such references is either very low (between 1 and 3) or 0 in the case of Minkel's (2007) piece in *Scientific American*. Reference is also made to other individuals or teams (including citations of authors of previous research) on 23 occasions by McCann et al. (2007).

However, the only derivative texts containing any such references are the newspaper articles in the *Daily Mail* (6 and 11) and *The Mirror* (2), though not the one in *The Times*. The references concerned are mainly to spokespersons for the food industry or for pressure groups, and to interested politicians.

Next we consider the tropes (or figurative expressions) of personification and concretisation. These do not appear in the antecedent text, a finding consistent with Wollman-Bonilla (2000: 48). As for the derivatives, personification is totally absent, while concretisation is found only in two of the newspaper articles: 2 occurrences in *Times* (2007) and 3 occurrences in Poulter (2007), though none in the report in *The Mirror*. An example of metaphorical concretisation occurs where Poulter (2007) speaks of a product containing an additive as having been “axed”.

As noted in 3.1 above, scientific discourse is associated with a formal, objective manner of writing in which emotive words and colloquialisms are both avoided. McCann et al. (2007) conform to this style. On the other hand, styles which do allow such expressions may be described as relatively “relaxed”. Among the derivative texts, the articles in *The Times* and the *Daily Mail* (though again not *The Mirror*) contain small numbers (maximally 5) of emotive words, for example “bizarre” (*Times* (2007)) and “shocking” (Poulter and Brogan (2007)). Colloquial words are also found in the two *Daily Mail* articles and, perhaps surprisingly, in *Scientific American*, examples being “rubbished” (Poulter (2007)) and “downing” in the sense of “swallowing” (Minkel (2007)). However, the numbers are again small (maximally 3).

Moving on to issues of grammar, we may first consider the incidence of the passive (also discussed by Keizer (this volume)). The percentage of passive verbal constructions in the antecedent text is 32.2%. The *EurekAlert* press-release has an even higher percentage (42.4%). As for the rest of the derivatives, only Poulter’s (2007) report (with 22.9%) lies within 10% of the figure for the antecedent text. The remainder all exhibit a lower incidence of the passive, ranging from 9.4%, in Poulter and Brogan’s (2007) campaigning article, to 16.7%, in Minkel’s piece in *Scientific American*. These results corroborate the findings of other authors whose work was reviewed in 3.1.

The majority of the passives in all the texts are agentless, for example:

- (19) Artificial food colours and other food additives (AFCA) have long been suggested to affect behaviour in children. (McCann et al. (2007: 1560)).

In the antecedent text the figure is 92.7%, and more than half of the derivatives were within 10% of this. However, two of the newspaper articles exhibited a 72.7% incidence of agentless passives. Unfortunately, it is difficult to discern any pattern here.

The overall grammatical complexity of the antecedent text, as measured in terms of clauses per sentence, is strikingly low (2.2). As for the derivatives, low complexities are again found, ranging from 1.9 in *EurekAlert* (2007) to 4.0 in Minkel (2007). With regard to nominal elaboration, the figure for the antecedent text is 4.2. Moreover, the derivatives all lie within 2 of this figure, apart from *EurekAlert* (2007) at 12.4. Whether these figures are high enough to support the notion of a “nominal” style (Halliday (2004c: 108)) in scientific writing, however, is highly debatable.

Turning to issues of discourse, we may begin with rhetorical structure. The antecedent article exhibits the typical IMRD. In this respect it differs from all the derivative texts, which manifest a “plain” structure that is not sectionalised in such a manner.

The rhetorical strategy in the antecedent text is based on reliance upon the weighing of evidence for the justification of its content; and the same is true of the press-release and the piece in *Scientific American*. However, the newspaper articles rely on the (perceived) authority of science.

With regard to modes of communication, the antecedent article is multimodal, as expected in the light of Lemke (1998: 87-91). In addition to the natural-language text, it exhibits 2 diagrams, 4 charts, 4 tables and 28 equations. In contrast, all the derivatives are unimodal, consisting of natural-language text only. (Poulter and Brogan (2007) is accompanied by a photograph of some sweet items, but the latter seems to function as a background illustration and is not integrated into the article.)

Some of our results call certain previous research findings into question, insofar as our analysis suggests that:

- (20) (a) Popularisations are *not* necessarily less technical than their antecedents.
- (b) Hedging is *not* necessarily a significant feature.
- (c) References to the scientists involved in the experiment are *not* necessarily suppressed in research papers.
- (d) Overall grammatical complexity is *not* necessarily high in research papers.

Our results reveal some of the ways in which the movement of content from the source context to different destination contexts has been accompanied by resemiotisation of that content. The most clear-cut instances are found where the change of genre from scientific research article to any other discourse-type attested in our sample is accompanied by a resemiotisation from multimodal to unimodal formulation, and from IMRD to plain discourse-structure.

Some of the other resemiotisation effects may also be traceable to particular contextual differences. For example, the inclusion of emotive or colloquial words in newspaper and magazine reports may be attributed (at least in part) to the difference in audience and purpose, compared with the academic antecedent text. An academic audience would not expect such informalities, which do not accord well with the purpose of communicating research results in a professional manner. On the other hand, a general audience may well be comfortable with an informal style, which helps to serve the authorial purpose of engaging (and not merely informing) the readership.

Moreover, the norms of journalism play a part in the decision to include a variety of comments from spokespersons in some of the newspaper articles in order to present a balanced range of views. Furthermore, within the journal article, the rhetorical principle of reliance on evidence as rhetorical strategy may be attributed to the ideology behind the scientific approach.

4. Conclusion

The recontextualisation analysis framework and method proposed in the present paper appear to have the potential to provide a reasonably detailed and interesting description of the phenomenon concerned, and to be fairly straightforward to carry out. Similarly, the resemiotisation analysis framework and method provide a means of describing how content may be recast during recontextualisation, and again seem to be fairly straightforward to execute. Pleasingly, they also have the potential to throw up unexpected results. Overall, the study has added to the available techniques for

analysing and describing recontextualisation and resemiotisation, and delivered a considerably more detailed analysis of these phenomena than is to be found in the existing literature on science communication.

These techniques have been applied in the present paper to an important area of science communication, namely the popularisation of science, where they have proved viable. A natural next step in the research process would be to test them out on corpora drawn from other domains, both inside and outside the field of science communication.

In relation to FDG and the associated EMC as a theoretical basis for our study, the following conclusions suggest themselves. The categories offered by the EMC have proved viable as units for the analysis of context and of recontextualisation in such a way as to support a discussion of the relationship between recontextualisation and the concomitant resemiotisation. As for the analysis of such resemiotisation, a theoretical foundation for a good part of this, though not all of it, is supplied by FDG (although it is not being claimed that other grammatical frameworks would have failed to serve such a purpose). The main future developments suggested by this study, in respect of FDG as currently conceived, relate to the lexicon. The latter could be subdivided into lexical fields or domains; characteristics such as emotiveness and (in)formality could be ascribed to particular lexemes; and figurative uses could be handled within a suitably elaborated theory.

Another area for future research lies in the development of a discourse model covering the wider model of verbal interaction; cf. Connolly (2010a, this volume). This would need to be sufficiently rich to support the discourse analysis carried out in the present investigation (among others). Not until the discourse model is in place will it be possible to formalise its operation in relation to studies such as this one.

If the model of verbal interaction is to account fully for the way in which language is used, then, unlike the grammatical model, it will need to cope not only with systematic but also with unsystematic relationships between text and context, some of which are attested in 3.3 above. On the other hand, the *organisation* of the Contextual Component needs to be principled, in order that the *relationship* between communication and context can be studied in a systematic manner. Of course, we should seek to find regularities in this relationship as far as possible. We should also investigate the role of the *Conceptual* Component in the production of associations that we classify as irregular, and also the part that it plays in the processes of transformation that underlie resemiotisation. Our final conclusion, then, is that much more research remains to be done.

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