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THE POPULARIZATION OF SPECIALIZED DISCOURSE AND KNOWLEDGE ACROSS COMMUNITIES AND CULTURES

O F F P R I N T

EDIPUGLIA
Bari 2013

'THE PHYSICS YOU BUY IN SUPERMARKETS' WRITING SCIENCE FOR THE GENERAL PUBLIC: THE CASE OF STEPHEN HAWKING

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Abstract

Between 1988 and 2010, the renowned British physicist Stephen Hawking wrote five popular science books aimed at bringing physics closer to a wider audience than the mere academia. The operation proved very successful – with his best-seller alone (*A Brief History of Time*, 1988) reported to have sold over 10 million copies[1] (Paris 2007) – and made him into an acclaimed popular author. This study considers the books Hawking wrote especially for popularizing purposes, presenting reflections on the relationship between specialized and popular discourse. It focuses in particular on Hawking's first such work, *A Brief History of Time*, which was made into an even more popular adaptation titled *A Briefer History of Time* (2005). The chapter details how the subject has been adapted and transferred from a high into a popular (writing) and an even more popular (re-writing) level. This is done by comparing the works against the general features of specialized/scientific discourse, to single out their variation from – or conformity to – the established norms thereof, providing samples of textual analysis and highlighting relevant lexical and syntactic phenomena. An interpretation of such phenomena is proposed according to Critical Discourse Analysis methodology, i.e. considering language in light of the many social, cultural and economic variables informing this type of communication.

1. Research questions

This chapter will examine Stephen Hawking's popular writing, and it will try to illustrate some of its linguistic aspects from a Critical Discourse Analysis (CDA) perspective, i.e. focusing on language as a cause and the result of social, cultural and economic phenomena (Fairclough 1995, 2003, 2006). It will be looking, in particular, at the linguistic realization of its popularizing purposes, from an English for Special Purposes (ESP) viewpoint (Cloître and Shinn 1985; Swales 1985 and 1990; Gotti 1991 and 1996; Garzone 2006).

Some of the questions that will be tackled are: was the disseminating aim of these texts achieved? If so, through which linguistic strategies? How is ESP used or adapted for dissemination? Was anything else achieved? What was the social impact of Hawk-

[1] Paris N. 2007, Hawking to experience zero gravity, in *The Telegraph*, 26 April 2007.

ing's best-sellers on science popularization at large? The answers to the above questions may contribute to shed some light on science popularization in the globalized era.

2. Topic and material

Prof. Stephen Hawking (b. 1942) needs little introduction. A world-renowned physicist, he is also well known among the public for both his best-selling dissemination books and for his many appearances (once frequent, now less so) in TV and radio shows, series, cartoons, films, comics, and on several other media. Indeed, it is interesting to see how he is introduced by three different sources – all freely accessible to the public, yet not all 'popular'.

> (1) Stephen William Hawking, CH, CBE, FRS, FRSA[2] (born 8 January 1942) is a British theoretical physicist and cosmologist, whose scientific books and public appearances have made him an academic celebrity (Wikipedia 2011).

> (2) Professor Stephen Hawking
> Career
> 1.2009 to Present: Director of Research, DAMTP[3], Univ. of Cambridge
> 2. 1979 to 2009: Lucasian Professor of Mathematics, Univ. of Cambridge
> 3. 1977 to Present: Professor of Gravitational Physics, Univ. of Cambridge
> 4. 1974 to Present: Fellow of the Royal Society
> Selected publications:
> 5. Technical […]
> 6. Popular […]
> 7. Children's Fiction […]
> 8. Films and series […]
> (DAMTP 2010).

> (3) Stephen Hawking is the former Lucasian Professor of Mathematics at the University of Cambridge and author of *A Brief History of Time* which was an international bestseller. Now Director of Research at the Institute for Theoretical Cosmology at Cambridge (Stephen Hawking - The Official Website 2013a).

The first biography (1) is Stephen Hawking's *Wikipedia* entry, perhaps *the* popular source by definition, open as it is to be authored and modified by any of its users.

[2] CH: Order of the Companions of Honour; CBE: Commander of the Most Excellent Order of the British Empire; FRS: Fellow of the Royal Society; FRSA: Honorary Fellow of the Royal Society of Arts.

[3] DAMTP: Department of Applied Mathematics and Theoretical Physics.

Wikipedia focuses on Hawking's honorary titles and calls him, as well as a cosmologist and a physicist, an "academic celebrity". Thus, it associates two apparently antithetic concepts stressing, in using "celebrity" as the noun phrase's head, the scientist's popular role, rather than the opposite, as in – for instance – "popular scholar". The second (2) is an academic source: Prof. Hawking's official file on the webpage of his Department at Cambridge. Apart from the academic posts he has held and still holds and his academic publications, which could be expected to be there, his listed publications also include the sections "popular", "children's fiction" and even "films and series". Finally, the last profile (3) is taken from Stephen Hawking's own official website, in which he defines himself a professor and the director of his research centre, but also a best-selling author. It is precisely Hawking's science-disseminating role that this chapter will deal with, focusing on his major popular books.[4]

Between 1988 and 2005, Professor Hawking published five popular – both in the sense of 'disseminating' and of 'best-selling' – books. These are all paperback or pocket books, i.e. the kind of books that may be bought at the local supermarket:

a) *A Brief History of Time*, 1988;
b) *Black Holes and Baby Universes and Other Essays*, 1993;
c) *The Universe in a Nutshell*, 2001;
d) *On The Shoulders of Giants. The Great Works of Physics and Astronomy*, 2002;
e) *God Created the Integers: The Mathematical Breakthroughs That Changed History,* 2005;
f) *A Briefer History of Time*, 2005.[5]

The list includes original work in the form of long essays (a, b, f) or collections of various essays (b), and edited scientific writings by other authors, with original introductions and commentaries by Hawking (d, e). Among the original long essays, a), the world famous *A Brief History of Time* (1988) constituted a landmark in contemporary science dissemination. *A briefer history of time* (2005), (f), is its revisited and simplified version. This paper will consider, precisely, these two books.

3. Popularization: a model

As a framework for describing, classifying and distinguishing popular texts, Cloître and Shinn's 1985 model may be of use. The authors identify four levels of scientific exposition:

[4] Previous research on aspects of Hawking's popular works abounds, and includes Jenkins (1992), Rodger (1992), White and Gribbin (2002), Mellor (2003).

[5] This list does include co-authored books, children's fiction and other genres.

- intra-specialist exposition (from specialist to specialist in same field);
- inter-specialist exposition (from specialist to specialist across fields);
- didactic/pedagogical exposition (from specialist to non-specialist);
- popular exposition (intended for the largest audience possible).

Dated as it is,[6] it is still a functional tool for describing the specialized to non-specialized continuum in communication. The features of intra- and inter-specialist level scientific texts have long and thoroughly been identified and researched by many in ESP and genre analysis, including Swales (1971), Gotti (1991, 1996), Halliday and Martin (1993), Halliday (1997, 2006), Garzone (2006), Banks (2008), Grego (2010), and may be summed up as follows:

- lexical level: high word formation, borrowings, noun strings, abbreviations, Latinization;
- syntactic level: nominalization, high modality, passive voice, depersonalization;
- textual level: thematization, schematization, cohesive conjunctions, hedging, omissions, crypticity (exclusiveness).

The characteristics of the non-specialized or popular scientific texts are of course antonymic to those of specialized texts:

- lexical level: few or no abbreviations, few or no noun strings, (over-)Anglicization;
- syntactic level: little use of nominalization, little use of modality, personalization wherever possible;
- textual level: schematization, exemplification, oversimplification, definitions, reformulation, explanations, multi-media elements (from visuals to interactive elements).

A Brief History of Time (hereinafter *Brief*) and *A Briefer History of Time* (hereinafter *Briefer*) should, of course, be samples of popular exposition. The basic assumption, therefore, is that they should present the lexical, syntactic and textual features of popular texts.

However, even a surface reading of the texts reveals a discrepancy with the expectations. Let us consider the same passage from both books.

> [1] The fundamental postulate of the theory of relativity, **as it was called**, was that the laws of science should be the same for all freely moving observers, no matter what their speed. This was true for Newton's laws of motion, but now the idea was extended to in-

[6] It is interesting to notice that *A Brief History of Time* dates from 1988: the early stages of academic research into ESP and popularization and Hawking's own popularizing effort began approximately in the same years.

> clude Maxwell's theory and the speed of light: all observers should measure the same speed of light, no matter how fast they are moving. **This simple idea has some remarkable consequences.** Perhaps the best known are the equivalence of mass and energy, summed up in Einstein's famous equation E=mc2 (where E is energy, *m* is mass, and *c* is the speed of light), and the law that nothing may travel faster than the speed of light.
>
> (*Brief*: 21, bold added)

As it appears by looking, even only graphically, at the excerpt above [1], *Brief*, right from the beginning, seems to suffer from a sort of 'genre granularity'. A concept derived from web genre analysis and corpus linguistics (cf., e.g., Mehler, Sharoff and Santini 2006), it indicates a hybridization phenomenon in which it is still possible to clearly distinguish two (or more) mixed genres – much like, in chemical terms, a suspension differs from a solution. Precisely, in this case, the mix is between the intra- / inter-specialist and the popular levels of scientific exposition which, in *Brief*, alternate in this way:

SD — pd — SD — pd — SD — pd — SD

In other words, the chunks of text containing specialized discourse (SD) are large, prevalent and are regularly-spaced by those including popular discourse (pd), which only function as short 'bridges' between them.

> [2] Einstein's fundamental postulate of the theory of relativity, **as it was called**, stated that the laws of science should be the same for all freely moving observers, no matter what their speed. This was true for Newton's laws of motion, but now Einstein extended the idea to include Maxwell's theory. **In other words, since Maxwell's theory dictates that** the speed of light has a given value, all freely moving observers must measure that same value, no matter how fast they are moving toward or away from its source. **This simple idea certainly explained – without the use of the ether or any other preferred frame of reference – the meaning of the speed of light in Maxwell's equations, yet it also had some remarkable and often counterintuitive consequences**.
>
> (*Briefer*: 32, bold added)

Briefer [2] also features genre granularity, but here its presence seems to be reduced, the texture looks tighter, and the distribution of the levels of exposition has been reversed, resulting, visually, in a structure such as:

SD — pd — SD — pd — SD — pd — SD — pd — SD

The question arises, then, of whether *Brief* and *Briefer* can (still) be considered popular texts.

In spite of the presence, especially in *Brief*, of much ESP exposition, it seems they can. The granularity phenomenon, indeed, is no novelty in science; in fact, it is neither a modern nor even a characteristically contemporary phenomenon. Scientific exposition and genre granularity have been coexisting for centuries, creating a long tradition in Western culture. One European precursor of Hawking in adopting this technique was Galileo Galilei (1564-1642) – no less.[7] In a recent paper (Grego and Lonati forthcoming), striking similarities emerged between contemporary and early modern scientific exposition. The result of expository granularity is that there appears to be a popular text *within* a specialized text – a sort of a book within the book.

Even so, although the ESP sections in both *Brief* and *Briefer* may at first, in two best-selling paperbacks, sound unexpected, to use Hawking's lexicon, they do not present any real "singularity", i.e. "a point in the universe where the theory itself breaks down" (*Brief*: 50) compared with the tradition of Western scientific exposition. Instead, as will be shown, both *Brief* and *Briefer* contain popular sections to a degree that allows considering them popular works and, indeed, they represent the most interesting sections in both books, especially in *Brief*, where they are less frequent and still very 'granulous', i.e. showing well-defined, clear-cut limits. Thus, it is precisely these popular 'texts within the texts' that prove the most interesting for the purposes of this research, and those that will be analyzed in the course of the next few paragraphs.

4. The discourse of popularization: a sample analysis

The following analysis will explore a sample of discursive strategies selected as representative of scientific exposition. For practical purposes, they will be classified into a number of CDA-based and -oriented categories, all functional to constructing the discourse of popularization:

(a) (over)explanation / (over)exemplification / (over)simplification;
(b) irony;
(c) argumentation;
(d) personal references;
(e) (critical) social references.

[7] Hawking closely identifies himself with Galileo – no less – again, as he states in *Brief*: "I had no desire to share the fate of Galileo, with whom I feel a strong sense of identity, partly because of the coincidence of having been born exactly 300 years after his death!" (*Brief*: 122).

(a) (Over)explanation / (over)exemplification / (over)simplification

Superlative magnitudes

To illustrate the (over)explanation / (over)exemplification / (over)simplification strategies, excerpts will be reported from a subcategory conveniently labelled 'superlative magnitudes', meaning simply 'extremely big numbers'.

This strategy is very frequently employed by Hawking in both books. Whenever he mentions astronomic magnitudes, or 'extremely big numbers', he likes to also write the whole number in words, often specifying in brackets the number of zeroes involved in the figure. Apparently, this might look like overexplanation, and thus it may at first be identified as a popularizing technique, for example in comparable excerpts [3] and [4], which are exactly the same in both *Brief* and *Briefer*. These passages, though, only feature five (5) repetitions, which itself is a magnitude that the non-specialized reader can easily handle – if not mathematically (it is a 31-digit number!), at least both linguistically (as a word repeated five times) and visually, in its printed form. However, does it make it easier for the public to repeat "million" not five (5) but fourteen (14) times, as done in [5]? Neither mathematically (it is difficult enough to imagine a 31-digit figure, let alone an 81-digit one), nor linguistically (one cannot confidently repeat a word fourteen times, without counting), nor does it seem easy to take in such a magnitude visually. What initially may seem an instance of overexemplification, is in fact revealed as further complicating an already complex specialized concept. It seems apparent that this kind of rhetorical strategy was derived from the material having been originally read out as lectures to students who, being threshold specialists at the didactic level, could both appreciate the intellectually refined pedantry and still be as shocked (and enter-

[3] According to Guth, the radius of the universe increased by **a million million million million million (1 with thirty zeros after it)** times in only a tiny fraction of a second.	[4] According to Guth, the radius of the universe increased by **a million million million million million (1 with thirty zeros after it)** times in only a tiny fraction of a second.
[...]	[...]
[5] There are something like **ten million million million million million million million million million million million million million million million million million million (1 with eighty zeros after it)** particles in the region of the universe that we can observe.	[not present in simplified version (*Briefer*)]
(*Brief*: 136, bold added)	(*Briefer*: 74, bold added)

tained) as the man in the street. In fact, this strategy, applied as it is in excerpt [5], cannot properly be called a popularizing technique, but is rather an instance of what could be termed 'pseudo-popularization', where the seeming simplification is in effect a complication. Therefore, the answer to the initial question – does the 14-time repetition make the concept easier for a popular audience to understand? – is: no, it does not. Rather, not mentioning the datum at all surely would do so, and that is precisely what was done in the 2005 version of the text, *Briefer*, where excerpt [5] was omitted altogether. It remains to be seen whether eliminating the passage completely is itself a simplification or a(nother) complication, i.e. whether it goes towards popularization or specialization. An interpretation will be proposed in the *Metalanguage* section.

Metalanguage

There are several passages in which Hawking provides his readers with metalinguistic explanations. It is to be noted that there are quite a few of these in *Brief* but not as many in *Briefer*.

[6] The word atom means "indivisible" in Greek

(*Brief*: 67)

[7] The word atom means "indivisible" in Greek

(*Briefer*: 69)

[8] At first it was thought that the nucleus of the atom was made up of electrons and different numbers of a positively charged particle called the proton, from the Greek word meaning "first"

(*Brief*: 68)

[9] Atoms are made of smaller particles: electrons, protons, and neutrons.

(*Briefer*: 70)

[10] The origin of the name [quark] is an enigmatic quotation from James Joyce: "Three quarks for Muster Mark!" The word *quark* is supposed to be pronounced like *quart*, but with a *k* at the end instead of a *t*, but is usually pronounced to rhyme with *lark*.

(*Brief*: 69)

[11] The protons and neutrons themselves are made of yet smaller particles called quarks.

(*Brief*: 70)

In some cases, e.g. in [6] and [7], metalinguistic explanations are quite simple and identical in both versions. In other cases, e.g. in [8] and [9], the expected differences

between *Brief* and *Briefer* are fully met: the earlier version is longer, provides more and more detailed information, and tends more towards ESP in both its lexicon and its syntax. Overexplanation, though, can often be qualitative, but it is necessarily a quantitative strategy. Thus, theoretically, the more popular a text, the more over-explanations it should include. However, in other cases again, the quantitative / qualitative proportion is not maintained, for instance when, given a longer explanation in a version (*Brief*), the concept comes out as clearer when explained more briefly in the other (*Briefer*): excerpts [10] and [11] well exemplify this. Is the reader any the wiser about the nature of quarks for knowing about Muster Mark? That seems doubtful. Again, this sounds more like pseudo-popularization, and again its presence could be ascribed to the original nature of *Brief* as collected reading material, with over-explanations as in [10] flouting the Gricean maxim of manner "Be brief (avoid unnecessary prolixity)" (1975: 46), in order to create moments of comic relief (see e.g. Nash 1985 and Chiaro 1992), such as may be offered for the benefit of students during a university lecture.

(b) Irony

Jokes and anecdotes

To add to the comic reliefs, *Brief* (and *Briefer*, too, but to a lesser extent) is peppered with ironic remarks as well as with more or less amusing anecdotes. These also contribute to the granularity of the texts, but sometimes in favour of popularization (as could well be expected), sometimes in favour of specialization.

[12] Imagine a cup of water falling off a table and breaking into pieces on the floor. If you take a film of this, you can easily tell whether it is being run forward or backward. If you run it backward you will see the pieces suddenly gather themselves together off the floor and jump back to form a whole cup on the table. You can tell that the film is being run backward because this kind of behavior is never observed in ordinary life. **If it were, crockery manufacturers would go out of business**. [...] This says that in any closed system disorder, or entropy, always increases with time. In other words,	[not present in simplified version (*Briefer*)]

it is a form of Murphy's law: things always tend to go wrong!

(*Brief*: 152-153, bold added)

[13] Newton was very worried by this lack of absolute position, or absolute space, as it was called, because it did not accord with his idea of an absolute God. In fact, he refused to accept lack of absolute space, even though it was implied by his laws. He was severely criticized for this irrational belief by many people, most notably by Bishop Berkeley, a philosopher who believed that all material objects and space and time are an illusion. **When the famous Dr. Johnson was told of Berkeley's opinion, he cried, "I refute it thus!" and stubbed his toe on a large stone**.

(*Brief*: 18, bold added)

[14] Newton was very worried by this lack of absolute position, or absolute space, as it was called, because it did not accord with his idea of an absolute God. In fact, he refused to accept lack of absolute space, even though it was implied by his laws. He was severely criticized for this irrational belief by many people, most notably by Bishop Berkeley, a philosopher who believed that all material objects and space and time are an illusion. **When the famous Dr. Johnson was told of Berkeley's opinion, he cried, "I refute it thus!" and stubbed his toe on a large stone**.

(*Briefer*: 23-24, bold added)

Jokes in both *Brief* and *Briefer* are not always particularly refined, but their effectiveness could only be tested by means of surveys among readers or, if told in a lecture room – as it is hypothesized they were in the first place – by the audience's reaction. Linguistically, they are very interesting and offer chances of interpretation.

Excerpt [12] is both an instance of overexplanation and overexemplification and, in the two sentences in bold, of jokes. In the first joke, the irony is caused by considering what so far had been a hypothetical event (broken cups mending themselves) as a real occurrence, and imagining the repercussion in real life (crockery manufacturers becoming unemployed). The second joke is in fact a popular culture quotation and an example of overexplanation / overexemplification. The more 'pop' the supposedly shared knowledge, the wider the audience that may be entertained by it, and Murphy's Law is quite well known in pop culture.[8] Why this passage should not be included in *Briefer* is not apparent. Both jokes are indeed quite pop culture-based, and could have easily been understood by a non-specialized audience. It can only be

[8] See, for instance, the popular book *A History of Murphy's Law* (Spark 2006). A revisitation of Murphy's Law concerned with probability is known as 'the tumbling toast (which is supposed to always land buttered-face down) problem', and has actually been termed so in academic writing (Matthews 1995; Borghi 2012).

suggested that it was the topic – entropy – that was omitted altogether as too demanding for *Briefer*'s public; indeed, entropy is never mentioned throughout the 2005 simplified version.

Excerpts [13] and [14] are identical in both texts. Both report Hawking's view on Newton (which is not very sympathetic but is highly respectful). Both also report the anecdote on Dr Johnson, of whom Hawking *is* fond. The episode remains in *Briefer* probably because, in itself, it does not offer much difficulty in being interpreted. Samuel Johnson is furthermore a very popular figure in English-speaking culture (and for once Hawking quotes a linguist not a scientist, at least in the sense in which the word is used today), and almost as popular as James Boswell, from whose *Life of Johnson* the story apparently comes.[9]

(c) Argumentation

Although the books have a disseminating purpose, and deal with several well-established topics in physics and astronomy, both *Brief* and *Briefer* do not stop at modern science, but go further and try to explore contemporary theories too.[10] This means entering the realm of the not-so-well-known-yet, as well as joining the ongoing scientific debate, of which Hawking is a protagonist. It is only natural that he should at least report on current issues in theoretical physics, and support his own views as he does so.

Classic rhetoric

Very often, the texts include overt argumentative markers with a performative verb introducing a declarative content clause, as in excerpts [15], [16] and [17].

> [15] In order to talk about the nature of the universe and to discuss questions such as whether it has a beginning or an end, you have to be clear about what a scientific theory is. **I shall take the simpleminded**

> [16] In order to talk about the nature of the universe and to discuss such questions as whether it has a beginning or an end, you have to be clear about what a scientific theory is. **We shall take the simpleminded**

[9] «After we came out of the church, we stood talking for some time together of Bishop Berkeley's ingenious sophistry to prove the non-existence of matter, and that every thing in the universe is merely ideal. I observed, that though we are satisfied his doctrine is not true, it is impossible to refute it. I never shall forget the alacrity with which Johnson answered, striking his foot with mighty force against a large stone, till he rebounded from it, 'I refute it *thus*'» (Boswell [1791] 1980: 333).

[10] Where 'modern science' indicates the advances brought forth between the 17th and the 18th centuries by the likes of Galileo, Kepler and Newton; while 'contemporary science' refers to later developments, contributed – in particular – by and after Darwin's evolutionary theory and Einstein's relativity theory in the 19th and 20th centuries.

quantities in the model to observations that we make. (*Brief*: 10, bold added)	quantities in the model to observations that we make. (*Briefer*: 13, bold added)
[17] In this chapter **I shall argue that** the no boundary condition for the universe, together with the weak anthropic principle, can explain why all three arrows point in the same direction. (*Brief*: 153, bold added)	[not present in simplified version (*Briefer*)]

In [15] and [16], the marker introduces a premise on what a theory is. Lexically, the focus is on the words "**simpleminded**" and "**we**". The former is interesting in that it is associated with someone "possessing little or no subtlety of intellect",[11] which is something Hawking is not, knows he is not, and certainly does not wish to sound. The use here is ironic or, rather, slightly critical towards more complex conceptions of the notion of theory. This explanation nonetheless results in a clear premise, definitely facilitating popularization. The pronoun "**we**" is the only discriminating element between [15] and [16]. It is supposedly due to *Briefer* technically having two authors (Leonard Mlodinow appears as the second author, although the copyright is entirely Hawking's), but it is also in line with *Briefer*'s wider disseminating purpose, and inclusiveness through first-person plural pronoun usage is extensive throughout the 2005 text.

In [15], the verb is both declarative and commissive, in pragmatic terms, since the author declares as well as undertakes to argue in favour of a given position. The choice of the term "**argue**", in its classic simplicity, is significant too: Hawking follows in the Western argumentative tradition of scientific exposition by treatise and does so by also using the language of classical argumentation. Whether the argument will turn out felicitous or infelicitous, in John Austin's words (1962: 14 ff.), does not depend on linguistic but on mathematical considerations. It is worth noticing that this passage is not included in *Briefer*, possibly due to the complexity of the notion of 'weak anthropic principle' involved, much like in the case of entropy [12].

Academic enemies

Occasionally, the scientific debate gets heated and Hawking, as one of its protagonists, not only is not afraid of supporting his own views, but does not fear attacking, in writing, other scientists. These turn into 'academic enemies' that he openly challenges – again, in the classical rhetoric tradition – from the pages of his books.

[11] OED (2013), s.v. SIMPLE-MINDED.

> [18] In 1972 I wrote a paper with Brandon Carter and an American colleague, Jim Bardeen, in which **we pointed out** that although there were many similarities between entropy and the area of the event horizon, there was this **apparently fatal difficulty**. **I must admit** that in writing this paper I was motivated partly by **irritation with Bekenstein**, who, **I felt, had misused my discovery** of the increase of the area of the event horizon. **However**, it **turned out** in the end that he was **basically correct**, **though** in a manner he had **certainly not expected**. [...] At first I thought that this emission indicated that one of the approximations I had used was not valid. **I was afraid that if Bekenstein found out about it, he would use it as a further argument to support his ideas** about the entropy of black holes, **which I still did not like**. However, the more I thought about it, the more it seemed that **the approximations really ought to hold**. But what finally convinced me that the emission was real was that the spectrum of the emitted particles was exactly that which would be emitted by a hot body, and that the black hole was emitting particles at exactly the correct rate to prevent violations of the second law. Since then the **calculations have been repeated** in a number of different forms **by other people**. **They all confirm that** [...]
>
> (*Brief*: 110-111, bold added)

This [18] is a tiny masterpiece of scientific argumentation. It develops along the following moves.

· Hawking *et al.* proposed a theory
  - we pointed out
· The theory was flawed
  - apparently fatal difficulty.
· Hawking admits writing the paper in response to irritation with academic enemy
  - I must admit irritation [...] with Bekenstein
· Explanation of reason for his irritation
  - Bekenstein, who, I felt, had misused my discovery
· Admission of enemy being right
  - However, it turned out in the end that he was basically correct
· Elucidation about enemy not being aware of why he was right (intellectual defeat of enemy, intellectual superiority of author)
  - though in a manner he had certainly not expected
· Fear of putting enemy in a stronger argumentative position
  - I was afraid that if Bekenstein found out he would use it as a further argument to support his ideas
· Reassertion of his own intellectual honesty (he did not like his enemy but he also scientifically disagreed with his theory)
  - which I still did not like
· Reaffirmation of belief in his own theory

- the approximations really ought to hold

· Resolution of diatribe: external (objective) judgment

- calculations have been repeated by other people

· Intellectual and scientific triumph of Hawking

- They all confirm that

Again, Hawking's prose well falls within the Western tradition of scientific exposition, from Aristotle, through Galileo and Newton, to Einstein. What truly distinguishes him and works like *Brief* and *Briefer* is their real popularizing intent, directed at – but also stemming from – a changed public, no longer made of a few literate intellectuals, or a limited oligarchy of European scientists, or even the new bourgeois seeking to collect books and knowledge for their social uplift. The fast evolving post-war world, with its democratic systems, new media and globalization, is increasingly hungry for information, and the more so for information about that science that makes the technology it uses daily work, but escapes its comprehension. Popular works like Hawking's surely meet the expectations in trying to bridge that gap, and prove successful commercially, bringing money and popularity to their authors, which in turn also contributes to promoting their academic work. On top, Hawking is a physicist, and "of all scientists in the twentieth century, physicists have reaped the most fame. In the popular view, scientific advance has generally been in the realm of physics" (Feldman 2000: 125).

The argument in [18] is perhaps too intrinsic to the world of physics to be reported in *Briefer*. Again, it too probably suffers from its didactic origin, acceptable in *Brief*, which is altogether more specialized, but not in *Briefer*, which is also directed at younger readers.

Of Nobel Prizes

Not exactly academic enemies, there are other figures in physics with whom Hawking engages argumentatively in his books. A section of its own is thus represented by Nobel Prize winners (in physics, of course).

> [19] [...] in 1979, Salam and Weinberg were awarded the **Nobel Prize** for physics, together with Sheldon Glashow, also at Harvard, who had suggested similar unified theories of the electromagnetic and weak nuclear forces. **The Nobel committee was spared the embarrassment** of having made a mistake by the discovery in 1983 at CERN (European Centre for Nuclear Research) of the three massive partners of the photon, with the correct predicted masses and other properties. **Carlo Rubbia**, who **led the team of several hundred physicists** that made the discovery, **received the Nobel Prize in 1984**, along with Simon van der Meer, the CERN engineer who developed the antimatter storage system employed. (**It is very difficult to make a mark in experimental physics these days unless you are already at the top!**).
>
> (*Brief*: 77, bold added)

For instance, excerpt [19] from *Brief* (not present in *Briefer*) sees Hawking describing the theory of the unified weak and electromagnetic interaction between elementary particles, for which Sheldon Glashow, Abdus Salam, Steven Weinberg were awarded the Nobel Prize in 1979. The information is followed by the sharp commentary that "**The Nobel committee was spared the embarrassment of having made a mistake**", a euphemism for saying that it was *luckily* proved right, by a following discovery. The implicit criticism is that the three scientists were trusted (and rewarded) based on purely theoretical grounds, since at the time "**particle accelerators were not powerful enough**" (*Brief*: 77) to prove them right, and "**few people believed them**" (*ibid.*). The day-saving discovery referred to was the one that earned the Italian physicist Carlo Rubbia his Nobel Prize in 1984. The commentary, this time, is more than sharp, it is openly bitter: "**It is very difficult to make a mark in experimental physics these days unless you are already at the top!**". The criticism goes out to the entire research system, as Rubbia at the time was already a leading physicist at CERN. It would be interesting to know whether Hawking, who has now been at the very top for decades, still subscribes to his view of thirty years ago.

But the real point at issue, when talking Nobels, is obviously Hawking's failure, so far, to secure one for himself.[12] As will be discussed later, he clearly does not consider himself less worthy of one than Rubbia or Einstein. Although the Nobel Prize dispute may seem a strictly specialized issue, the repercussions at the popular level are relevant, because "the prizes certify who the 'great' scientists are. But by thrusting the laureates into the public eye, they help strip away the aura of distance" (Feldman 2000: 116). For one who willingly decided to go popular, and seems to have been enjoying every single day of his popularity, a call from Stockholm would represent recognition by the public as much as by the international scientific community.

(d) Personal references

Amyotrophic lateral sclerosis (ALS)

One of Hawking's defining features is undoubtedly his physical disability. Indeed, "his great gifts, tied to a cruelly crippling disease, electronic voicebox, and wheelchair, excited public interest in his TV appearances and helped make him a media superstar" (Feldman 2000: 116).

[12] Although "he was awarded the CBE in 1982, and was made a Companion of Honour in 1989. He is the recipient of many awards, medals and prizes" (Stephen Hawking - The Official Website 2013b), and has been a Fellow of the Royal Society since 1974 (The Royal Society 2013).

> [20] I was a research student desperately looking for a problem with which to complete my Ph.D. thesis. Two years before, **I had been diagnosed as suffering from ALS, commonly known as Lou Gehrig's disease**, or motor neuron disease, and given to understand that **I had only one or two more years to live**. In these circumstances there had not seemed much point in working on my Ph.D. – I did not expect to survive that long. Yet two years had gone by and I was not that much worse. In fact, things were going rather well for me and **I had gotten engaged** to a very nice girl, Jane Wilde. **But in order to get married, I needed a job, and in order to get a job, I needed a Ph.D**.
>
> (*Brief*: 53, bold added)

Excerpt [20] (only present in *Brief*) reports the author's own story of his condition. As any good scientist ought to do, he starts by naming and explaining the disease ("**I had been diagnosed as suffering from ALS, commonly known as Lou Gehrig's disease**"). He then curtly moves to two personal, moving considerations: "**I had only one or two more years to live**", "**I had gotten engaged**". Afterwards, the exposition goes back to logical reasoning, as he presents the argument resulting from the above considerations: "**But in order to get married, I needed a job, and in order to get a job, I needed a Ph.D.**". In this way, the anecdote starts out as scientific exposition, acquires an intimate tone, but finishes as logical argumentation, bringing the subject back to physics and to why Hawking got into it professionally. However, although it is exposed scientifically, just like the other facts and arguments in the book, all the information provided here is strictly personal. The contrast between the logical attitude and the touching situation is in fact a good popularizing strategy, both in the sense that it deals plainly and clearly with a rare medical condition, and that it contributes to inspiring sympathy for its protagonist by bringing people closer to his ordeal.

But why tell about his disease in the first place? Why not? Was it a marketing move? A necessity? It can only be hypothesized that it probably came as a reply to the curiosity raised by his appearance, one that cannot be disguised, and had to be addressed anyway if he were to really become a public – in the sense of popular – figure. Also, where ALS excluded him from "normality", by telling the "normal" people about it, he included *them* into the personal life of a scientific genius, and thus reversed the inclusiveness relationship with his audience, creating empathy (not pity), and at the same time contributing to raising his own profile and public awareness of ALS. The reason why this passage is not present in *Briefer* may be due to the 2005 version including young readers as its target, thus making such delicate issues less appropriate (see §5).

Great amongst the greatest

Hawking's scientific and popularizing genius is unquestionable. Just *how much* of a

genius he is as a physicist, only time and his fellow scientists can tell; how much of a genius he is at non-specialized exposition may be more easily tackled in linguistic studies such as this. From the analysis of *Brief* and *Briefer* what emerges is Hawking's (very high) consideration of his own role in physics.

> [21] A proper understanding of the electron and other spin-½ particles did not come until 1928, when a theory was proposed by **Paul Dirac**, who later was elected to the **Lucasian Professorship** of Mathematics at Cambridge (the same professorship that **Newton** had once held and that **I** now hold).
>
> (*Brief*: 72, bold added)

Excerpt [21] is a paradigmatic example of Hawking's self perception as a scientist. He simply lists names such as Paul Dirac's and Isaac Newton's, and quietly juxtaposes his own as another holder of the Lucasian Professorship of Mathematics at Cambridge. He does better than that: he actually mentions Dirac first and, commenting on him, he casually drops that the same professorship held by Dirac was once held by Newton and *currently* by himself. His name thus appears, in a very natural way, as immediately following Newton's.

This consideration is not present in *Briefer*, where professorships would perhaps not be of much interest to the great public. However, *Briefer* too features the three short files included at the end of *Brief*, on the three physicists that Hawking seems to respect the most: Galileo (sharing a birthday with him), Newton and Einstein. The implication is, of course, that he is next in line.

(e) (Critical) social references

Finally, both *Brief* and *Briefer* include open references to the books' popularizing purpose and social role that are worth mentioning. Excerpts [22] to [25] represent a sort of 'meta-popularizing' discourse within the popularizing discourse itself.

> [22] [...] modern science has become so technical that only a very small number of specialists are able to **master the mathematics** in a form that **people without a scientific education** can understand. This is what **I have attempted to do** in this book.

> [23] In the years since *A Brief History of Time* was published, [...] it was [...] clear from the feedback that **few readers are seeking a lengthy dissertation befitting a college-level course in cosmology**. Thus, the present approach. In writing *A Briefer History of Time* we have maintained and expanded the essential content of the original

book, yet **taken care** to maintain its length and **readability**. This is a briefer history indeed, for **some of the more technical content has been left out**, but we **feel** we have more than compensated for that by the **more probing treatment of the material that is really the heart of the book.**

(*Brief*: vi, bold added) (*Briefer*: 1-2, bold added)

[24] **Only a few people can keep up with the rapidly advancing frontier of knowledge, and they have to devote their whole time to it and specialize in a small area. The rest of the population has little idea of the advances that are being made or the excitement they are generating.** [...] If a complete unified theory was discovered, it would only be a matter of time before it was **digested and simplified in the same way and taught in schools**, at least in outline. We would then all be able to have some understanding of the laws that govern the universe and are responsible for our existence.

(*Brief*: 178, bold added)

[25] **Only a few people can keep up with the rapidly advancing frontier of knowledge, and they have to devote their whole time to it and specialize in a small area**. **The rest of the population has little idea of the advances that are being made or the excitement they are generating.** [...] If a complete unified theory was discovered, it would only be a matter of time before it was **digested and simplified in the same way and taught in schools**, at least in outline. We would then all be able to have some understanding of the laws that govern the universe and are responsible for our existence.

(*Briefer*: 136, bold added)

Passages [22] and [23] are from the Acknowledgments (*Brief*) and the Foreword (*Briefer*) sections respectively, and are quite self-explanatory. In [22], Hawking declares that his aim in writing *Brief* was – concisely – to "**attempt**" to teach "**people without a scientific education**" how to "**master mathematics**". Ambitious as it may seem, this was the intent he pursued in his first book – successfully, it seems, in the popular sections, perhaps less so in the specialized ones, which come out as quite granular blocks hardly accessible to the layperson. [23] is longer because it is a necessary expansion on [22]: an apologetic description of what went wrong in the original book is firstly given ("**few readers are seeking a lengthy dissertation befitting a college-level course in cosmology**"), followed by a new declaration of intent: leaving out "**some of the more technical content**", providing a "**more probing treatment of the material that is at the heart of the book**", and "**taking care to maintain its length and readability**". In this respect, *Briefer* seems to have more successfully reached its declared aim, in that it presents with less granularity, a lot of specialized information has indeed been left out, and the popular sections have been expanded and simplified.

The same disseminating intention is repeated and reinforced at the end of the last

chapters of both books ([24] and [25]), using the same words ("**Only a few people can keep up with the rapidly advancing frontier of knowledge, and they have to devote their whole time to it and specialize in a small area. The rest of the population has little idea of the advances that are being made or the excitement they are generating**"), which sound soberly suited to the current years (*Briefer* was published in 2005), but were certainly very sharp and prophetic for the times – some 30 years ago – when they first appeared in *Brief*, in 1985.

5. Emerging trends

Following the sample analysis of the language of popularization of *Brief* and *Briefer* presented in the previous paragraphs, it is possible to make at least a few informed considerations about the two books.

Both feature hybridization phenomena. The non-specialized (popular) and the specialized (ESP) levels of exposition (Cloître and Shinn's 1985) mix in both texts, creating granularity. In *Brief* the degree of granularity is much higher than in *Briefer*. Not only, the proportions of specialized vs. non-specialized sections is unbalanced in favour of the former, with large chunks of ESP passages only linked by short popular sections (sometimes even just phrases) acting as bridges. In *Briefer*, the alternation is much more balanced, in fact tending towards a predominance of the popular from both a quantity and a quality viewpoint. The ESP sections are much reduced and do not go into such detail as those in *Brief*.

The reason for this shift seems to be a different target audience for the two books. *Brief*'s features place it at the inter- (sometimes intra-) specialist to didactic level. It is definitely more didactic than popular, and often more specialized than didactic. In fact, Hawking's admission in the Foreword of *Briefer* indicates that *Brief* sounded much like "a lengthy dissertation befitting a college-level course in cosmology" (*Briefer*: 1), so it could indeed have been based on the author's own lecturing material, assembled and collected over the years. Probably, the discrepancy between the aim and the results of *Brief* derives precisely from a slightly distorted scholarly view of lecture-level material as being *already* quite popular. Actually, though, it proves mostly didactic, i.e. directed at users on the threshold of the community of practice, who should be – if not familiar – at least familiarizing with the specialized lexicon, genres and discourse of the community in question. The book indeed *promises* a much more popular approach than it can actually provide, yet turning such didactic material into a supermarket paperback without much heavy editing resulted in a very granular hybrid, albeit a best-selling one. Of course, no matter how precise statistics on sales are (*Brief* is reported to have sold

over 10 million copies, Paris 2007), no one can ever count how many books were actually *read*.

Also, perhaps due to Hawking's having in mind an audience of university students or other informed readers, *Brief* is definitely more of an 'adult' book. It surely contains adult irony, which can only be understood by readers sharing certain grown-up experiences or notions (see excerpts [12] to [14]). For the same reason, *Brief* is also more ideologically committed, in the sense that, for instance, it often refers to God in abstract or theoretical ways, especially when dealing with the universe (42 occurrences of the word 'god*' in its various acceptations). Finally, the presence of graphic elements in *Brief* is very scarce, with just a few black and white graphs and illustrations, all quite technical.

Briefer, on the other hand, was purportedly intended to address a different public, belonging to the didactic to popular level. The didactic audience, however, is more likely to be understood here as a school- rather than university-level audience, thus also looking to include younger readers. In fact, only an attempt at reaching a different audience fully justifies a new edition of an already very successful book, involving a second author, as the "updates on the latest research" promised on the cover of the book do not actually occupy more than a few pages in the final chapters. The result is a much less specialized text, and a much more popular one. Popular features include the larger format, and the much-increased relevance of the iconic aspect: the many colourful illustrations, the inclusion of humorous images and graphs all make the product more appealing to its intended audience, if less scientific-looking. Considering the potential young readers, the type of irony is also different, with sometimes entire anecdotes and jokes removed. God is less frequently mentioned (33 times), with some particularly delicate passages from *Brief* having been altogether omitted in *Briefer*. For instance, a sentence from *Brief* mentioning indeterminism ("The doctrine of scientific determinism was strongly resisted by many people, who felt that it infringed God's freedom to intervene in the world, but it remained the standard assumption of science until the early years of this century", *Brief*: 57), completely disappeared in *Briefer*, which thus proves more ideologically neutral.

6. Final CDA-based remarks

Drawing some CDA-based conclusions, then, it is definitely possible to maintain that "Hawking's *Brief history* shows that 'scientifically correct', 'ideologically acceptable' 'effective' or 'objective' vulgarization of science is indeed a reachable ideal" (Cornelis 1998). *Brief* presents with some limits with respect to its intended popularizing aim, some of which are quite relevant, yet do not entirely prevent the book from reaching a much wider audience than that at the intra- and inter-specialist levels of specializa-

tion. However, its strong orientation toward the (university) didactic level makes it so granular that it still looks like a very hybrid text, for which reason it is perhaps more suitable to view it in terms of *pseudo-popularization*. The actual popularization – as seen – only occurs in *Briefer*, but then the question arises of whether *Briefer* can be considered a text of its own. After all, it is an edited version of *Brief*, with most of its text having been taken 'as is' from the earlier book. Additions are minimal, reformulations almost non-existing, though omissions abound. In other words, where *Brief* is for sure an instance of (more or less successful) popular writing, *Briefer*, to a certain extent, is a successful attempt at re-writing, or interpreting (see the presence of the second author) an already existing text. A suggestion to make sense of the discrepancies and similarities could be to look at *Brief* and *Briefer* not as *two* separate works, but as different phases of *one* large popularization project. Indeed, the fact that it took their author twenty years to complete should not be surprising, given that the didactic (*Brief*) and the popular (*Briefer*) levels are *not* typical of Hawking's community of practice (it even took a second author to edit *Briefer* to reach an acceptable level of popularization).

Following this view would have the further advantage of seeing Hawking's entire scientific contribution as one and the same work, one single collection of material, modulated into all the levels of exposition: the corpus of his specialized or academic publications (intra-specialist), *Brief* (inter-specialist to didactic), *Briefer* (didactic to popular). The popularizing aim of Hawking – not a disseminator by profession – could thus be said to have been reached in two stages, just like a professional disseminator might take as long to turn one of his works into an acceptable academic text. Also, luckily, Prof. Hawking did not only work on *Brief* and *Briefer* between 1985 and 2005; his other intra-specialist projects surely account for the 20-year gap between his two acclaimed best-sellers.

To conclude, since this is a *linguistic* study of Hawking's popular exposition, here is one (the only) statement of his about language that gives linguists a lot of credit:

> [...] in the nineteenth and twentieth centuries, science became too technical and mathematical for the philosophers, or anyone else except a few specialists. Philosophers reduced the scope of their inquiries so much that Wittgenstein, the most famous philosopher of this century, said, "**The sole remaining task for philosophy is the analysis of language**".
>
> (*Brief*: 185; *Briefer*: 142, bold added)

Not only, this assertion is also important in that it reinforces Hawking's position in favour of science popularization, it represents an instance of critical social communication, and it looks to a not-so-distant past when science and philosophy were not separate.

However, he himself sticks to the distinction between the 'hard' (scientists) and the 'soft' (philosophers) sciences that has characterized the contemporary era and has especially grown in the 20th century. Well aware of his scientific worth, he makes it clear that he does not belong with the philosophers, but is one of those few lucky specialists. So he also feels the need to add:

> **What a comedown** from the great tradition of philosophy from Aristotle to Kant!
> (*Ibid.*, bold added)

In other words, it seems he would consider Galileo-Newton-Hawking to constitute an ascending curve, and Aristotle-Kant-Wittgenstein (the latter by implication) a descending one.

To this, linguists could only reply that, to reach the wide audiences he did with *Brief* and *Briefer*, he too had to surrender to using language according to all the popularizing strategies required by the task (so to playing the philosopher) and that the task took him two books and over twenty years. It could also be argued that that unifying theory of gravity and quantum mechanics he and his fellow physicists have been after for about a century (and which he so well disseminated in his popular books) is not unlike the unifying perspectives scholars in many fields are looking for today (including linguists and, by definition, philosophers), and that a re-unification of the soft and hard sciences as they were in past centuries could be one step towards finding it. In this view, Aristotle-Kant-Wittgenstein can hardly be seen as a poorer sequence than Galileo-Newton-Hawking, but rather as the way philosophy reflects the evolution of society, its contradictions, but also its needs and strengths. Just the same, the set of Hawking's lifetime achievements – his academic work, *Brief*, *Briefer* and his other popular books – are not barbarizations of science but different expository levels of it and, like all innovative research, a terrific demonstration of the potential of man – both the scientist and the philosopher.

References

Primary

Hawking S. 1988. *A Brief History of Time*. Toronto and London: Bantam.

Hawking S. 1993. *Black Holes and Baby Universes and Other Essays*. London: Bantam.

Hawking S. 2001. *The Universe in a Nutshell*. London: Bantam.

Hawking S. 2002. *On The Shoulders of Giants. The Great Works of Physics and Astronomy*. Philadelphia and London: Running Press.

Hawking S. 2005. *God Created the Integers: The Mathematical Breakthroughs That Changed History*. Philadelphia and London: Running Press.

Hawking S. 2005. *A Briefer History of Time*. London: Bantam.

Secondary

Austin J. 1962. *How to do Things with Words: The William James Lectures delivered at Harvard University in 1955*, J. O. Urmson (ed.). Oxford: Clarendon.

Banks D. 2008. *The development of scientific writing. Linguistic features and historical context*. London-Oakville: Equinox.

Borghi R. 2012. On the tumbling toast problem. *European Journal of Physics*, vol. 33, 1407-1420.

Boswell J. 1980 [1791]. *Life of Johnson*. Oxford: Oxford University Press.

Chiaro D. 1992. *The Language of Jokes. Analysing Verbal Play*. London and New York: Routledge.

Cloître M. and T. Shinn 1985. Expository practice: social, cognitive and epistemological linkages. In T. Shinn and R. Whitley (eds.), *Expository Science. Forms and Functions of Popularization*. Dordrecht: Reidel, 31-60.

Cornelis G.C. 1998. Is popularization of science possible?, paper given at the *Twentieth World Congress of Philosophy*, in Boston, Massachusetts from August 10-15, 1998. Available at http://www.bu.edu/wcp/Papers/Scie/ScieCorn.htm, consulted on 25 March 2013.

Fairclough N. 1995. *Critical Discourse Analysis: The Critical Study of Language*. London: Longman.

Fairclough N. 2003. *Analysing Discourse: Textual Analysis for Social Research*. London: Routledge.

Fairclough N. 2006. *Language and Globalization*. London: Routledge.

Feldman B. 2000. *The Nobel Prize: A History of Genius, Controversy, and Prestige*. New York: Arcade Publishing.

Garzone G. 2006. *Perspectives on ESP and Popularization*. Milan: CUEM.

Gotti M. 1991. *I linguaggi specialistici: caratteristiche linguistiche e criteri pragmatici*. Scandicci: La Nuova Italia.

Gotti M. 1996. *Robert Boyle and the Language of Science*. Milan: Guerini.

Grego K. and E. Lonati 2012. Reasoning, Rhetoric and Dialogue in Galileo's Mathematical Discourses. In Mazzon, G. & L. Fodde (eds.), Historical Perspectives on Forms of English Dialogue, Franco Angeli, Milano.

Grego K. 2010. *Specialized Translation*. Monza: Polimetrica.

Grice P. 1975. Logic and conversation. In P. Cole and J. Morgan (eds.), *Syntax and Semantics*, vol. 3. New York, Academic Press, 41-58.

Halliday M.A.K. and J.R. Martin 1993. *Writing Science: Literacy and Discursive Power*. London: Routledge.

Halliday M.A.K. 1997. On the grammar of scientific English. In C. Taylor Torsello (ed.), *Grammatica. Studi interlinguistici*. Padova: Unipress, 21-38.

Halliday M.A.K. 2006. *The Language of Science*. London: Continuum.

Jenkins H.R. 1992. On being clear about time. An analysis of a chapter of Stephen Hawking's *A brief history of time*. *Language Sciences*, vol. 14 (4), 529-544.

Matthews R. A. J. 1995. Tumbling toast, Murphy's Law and the fundamental constants. *European Journal of Physics*, vol. 16, 172-176.

Mehler A., S. Sharoff and M. Santini (eds.) 2006. *Genres on the web. Computational models and empirical studies*. Dordrecht-Heidelberg-London-New York: Springer.

Mellor F. 2003. Between fact and fiction. Demarcating science from non-science in popular physics books. *Social Studies of Science*, vol. 33/ 4, 509-538.

Nash W. 1985. *The Language of Humour. Style and Technique in Comic Discourse*. London and New York: Longman.

Paris N. 2007. Hawking to experience zero gravity. *The Telegraph*, 26 April 2007.

Rodger M. 1992. The Hawking phenomenon. *Public Understanding of Science*, vol. 1/2, 231-234.

Spark N. T. 2006. *A History of Murphy's Law*. Los Angeles: Periscope Film.

Stephen Hawking - The Official Website 2013a. "Home", retrieved at http://www.hawking.org.uk, on 25 March 2013.

Stephen Hawking - The Official Website 2013b. "About Stephen", retrieved at http://www.hawking.org.uk/about-stephen.html, on 25 March 2013.

Swales J.M. 1971. *Writing Scientific English*. London: Thomas Nelson.

Swales J.M. (ed.) 1985. *Episodes in ESP*. Oxford: Pergamon.

Swales J.M. 1990. *Genre Analysis: English in Academic Research and Writings*. Cambridge: Cambridge University Press.

DAMTP - The Department of Applied Mathematics and Theoretical Physics (2010). "Professor Stephen Hawking", retrieved at http://www.damtp.cam.ac.uk/people/s.w.hawking/, on 25 March 2013.

The Oxford English Dictionary 1989, 2nd ed., online version, available at http://www.oed.com/, last consulted on 25 March 2013.

The Royal Society 2013. "Fellows", retrieved at http://royalsociety.org/about-us/fellowship/fellows/, on 25 March 2013.

White M. and J.R. Gribbin 2002. *Stephen Hawking: a life in science*. Washington: Joseph Henry Press.

Wikipedia 2011, s.v. "Stephen Hawking", retrieved at http://en.wikipedia.org/wiki/Stephen_Hawking, on 26 January 2012.

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