Constructing a "breakthrough": News values in Science Magazine's 2017 ranking of most important discoveries

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1. Introduction

At the end of each year news outlets offer their readers various kinds of rankings: lists of the most influential politicians, of the most successful companies, of the best/worst movie productions, etc. It can be observed that the "genre" of the end-of-the-year ranking list has stabilized and become an acceptable, even expected, form of infotainment. Arguably, it has been popular not only because it meets readers' deeply ingrained needs for closure, hierarchy and evaluation in the midst of their chaotic media-saturated reality laden with fake news, but also because it is relatively easy and cheap to produce such coverage. From the perspective of digital journalism, the end-of-the-year rankings can be seen as devices to persuade more readers to spend more time on the website of an outlet, and, if found somehow controversial or surprising, to repost, retweet or otherwise remediate the rankings in a chain of viral marketing for the outlet. It seems that even prestigious science-related news distributors, such as *Science Magazine*,[1] are not immune to this editorial practice. *Science*'s

[1] *Science Magazine,* or *Science*, is the journal of the American Association for the Advancement of Science (AAAS) and one of the world's top academic journals that covers a wide scope of scientific disciplines. Published since 1880, it is now available in weekly print editions and in continuous online access with some content only by subscription. The journal publishes important original scientific research and research reviews, science-related news, opinions on science policy and implications of science and technology.

list of scientific "breakthroughs" of the year 2017 is featured at its homepage http://www.sciencemag.org and will be subject to a news value analysis in this study.

The objective of this article is to report on a critical stylistic analysis of the synoptic articles publicized by *Science* in the form of its end-of-the-year ranking list of 2017 scientific "breakthroughs." The textual material comprises 13 synopses (10 breakthroughs and 3 breakdowns) amounting to a corpus of approximately 6,200 words.[2] On the *Science*'s website, these articles are additionally illustrated with images or photographs and supplemented with videos and links to original scientific articles. However, it is only the verbal mode that is analyzed in detail here, as the illustrations are mainly taken from banks of images and rarely bring added news value to the coverage. The main aim is to identify the stylistic devices that construct a scientific discovery as a "breakthrough" worth revisiting in *Science*'s ranking list.

Such framing can be treated as yet another case of rhetorical and stylistic "science accommodation" (Fahnestock 1986), where complex reasoning, terminological specificity and tentative conclusions typical of academic publications are given up in an effort to acquaint non-specialists with the special merit and/or utility of the discovery that is reported. Accommodated science takes advantage of simplified exposition, less strict terminological nuancing and straightforward representations of conclusions. On the other hand, the construction of scientific news as "breakthroughs" also testifies to the increasing mediatization of science. It has been documented that in a market-driven context, some media outlets capitalize on controversies in the scientific world (e.g. GMO, stem cell research, gene therapy, nanotechnology, artificial intelligence, climate change) to increase readership (Nelkin 1996, Bucchi 1998, Boykoff 2011). In the last decade, the trend towards "scientific sensationalism" has been explored with regard to the reception of science-related news. Scholars have concluded that hyped-up and hysterical coverage of scientific facts causes confusion, diminishes scientists' credibility and inhibits the public understanding of science, as with "alarmist" global warning predictions that were easy to dismiss (Risbey 2008), or "Frankenstein" stories overlaying the coverage of therapeutic cloning (Jensen 2012).

Notwithstanding this, science accommodated by any commercial, market-driven and readership-oriented news outlet will inevitably follow the criteria of

[2] http://vis.sciencemag.org/breakthrough2017/index.html

newsworthiness, also known as "news values" or "news factors" (Harcup and O'Neill 2001). Various typologies of news values have been proposed in the literature on journalistic practices since the pioneering work on this editorial practice by Galtung and Ruge (1965). These typologies diverge because they reflect the thematic specificity of the coverage that was sampled and the inductive reasoning behind the identification of newsworthiness criteria in each study. It is logical that the agenda in the coverage of the most important events related to international politics prepared for educated audiences of a broadsheet daily newspaper differs from the criteria adopted to bring some sporting events to the attention of tabloid readers.

That is why in this study the general typology of news values is narrowed to the selection of newsworthiness criteria that, according to previous research, are more likely to be applied by science-column editors than general news editors (Guenther and Ruhrmann 2013, Molek-Kozakowska 2017b). These include covering events that are characterized by novelty (or unexpectedness), superlativeness (in scale or scope), timeliness (recency in discovery and immediacy in application), negativity (e.g. threat, danger) or positivity (e.g. solution, recovery), as well as prominence, which includes references to elite institutions, countries or individuals. Such an adjusted news values typology, treated here as a reflection of editorial practices of selectivity and framing, is then operationalized for a stylistic analysis. This study continues the line of research found for example in Bednarek and Caple (2012, 2014, 2017) which demonstrates that news values are not inherent in the events but the events can be discursively constructed as newsworthy by means of a specific choice of language and image (Bednarek and Caple 2012: 42).

As science popularization is a specific area of journalism, it is important to note that it constitutes a stylistic hybrid between academic writing and popular journalistic genres (Molek-Kozakowska 2017a, 2017b). This study traces how the news values responsible for making science-related coverage attractive are superimposed on the stylistic conventions of academic exposition, most notably revealed through the rhetorical structure of scientific reports or articles (Fahnestock 1986, Latour 1987). These include, above all, the linguistic techniques oriented towards providing rationalization of scientific merits, which might combine the realizations of the rhetorical *logos* and *ethos*. After all, science popularization synopses, even in the case of infotaining end-of-the-year rankings, are not aimed to undermine the credibility of the source, or to question

the logics of scientific research and publishing. The "rationalization cues" that will be analyzed here in tandem with news values include, among others, the stylistic patterns of exposition (i.e. cause-effect, problem-solution, theory--exemplification), attribution (relating to original sources), and authority appeals to the high institutional grounding of "normal science" (Kuhn 1962, Bazerman 1988), which is the case with new, often controversial, discoveries framed as "breakthroughs."

2. News values and rationalization cues in science popularization

The aim of this study is to identify the main strategies of making science stylistically constructed as newsworthy (Bednarek and Caple 2012: 44), with special attention paid to the description of lexical and grammatical features that have been used to legitimize science-related information to appear as a "breakthrough" that deserves to be revisited in the end-of-the-year ranking list. Following Biber and Conrad's approach (2009: 54), stylistic patterns are defined here as relatively stable constellations of "frequent and pervasive linguistic features" that are more common in a given textual sample than in other registers, and appear to be the communicator's choice, not the result of situational or institutional discourse constraints. Similarly to literary works, which use language for the sophisticated construction of fictional worlds, popular journalism often draws on stylistic resources to set the agenda of significance and to construct news items as extraordinary through its textualities (Bell 1991, Molek-Kozakowska 2017c). This perspective justifies making a selection of linguistic properties which are pervasive in the sample analyzed here, as seen against the backdrop of such "neighboring" discourses as non-scientific popular journalism (Richardson 2007, Bednarek and Caple 2012, 2014) on the one hand, and scientific or academic discourse (Hyland 2000, Perez-Llantada 2012) on the other.

First of all, science news oscillates between certainty and controversy and between negativity and positivity. Negative aspects of events, which in general news outlets tend to effectively build newsworthiness, may be realized through (1) negative evaluative modifiers, (2) reference to negative emotion and attitude, or (3) lexical items that refer to undesirable states and actions (Bednarek and Caple 2012, 2014, 2017). Given some current crises and

controversies, readers may expect a dose of negative information (cf. the notion of "breakdown" in this sample); however, even if the overall scientists' findings are sometimes worrisome, all scientific coverage can be evaluated as *de facto* positive because it reports on new knowledge, gives a better explanation, offers a warning or a remedy. The oscillation between negativity and positivity in science coverage is an important stylistic pattern that characterizes science journalism (cf. Jensen 2012, Molek-Kozakowska 2017a). In this study, the sampled texts will not be coded for news values of positivity and negativity, as the ranking list is *a priori* categorized as positive news ("breakthroughs" in articles 1-10) and negative news ("breakdowns" in articles 11-13). This sorting in no way detracts from the present analysis; in fact, it enables a more focused approach to analyzing the stylistic mechanisms of constructing "breakthrough" science.

The remaining part of this section is devoted to the review of literature on how the five remaining news values typical of science coverage (novelty, superlativeness, timeliness, impact and prominence) can be operationalized in terms of specific stylistic choices, and closes with a description of six rationalization values that will also be identified in the sample.

The news value of novelty, according to Bednarek and Caple (2012: 43), includes not only newness but also unexpectedness, and is sometimes described as "deviance," "rarity" or "surprise". Bednarek and Caple (2014) exemplify the following linguistic realizations of this value: (1) modifiers that evaluate the degree of unexpectedness, e.g. *unexpected, contrary to assumptions* (2) comparisons that indicate rarity, e.g. *one per million*; (3) references to surprise as an emotion displayed by social actors involved in the event, e.g. *striking, startling*; and (4) references to unusual happenings and extraordinary events, e.g. *first ever, never seen before*.

Novelty is likely to coexist with superlativeness, which is the stylistic "maximizing or intensifying of particular aspects of an event" (Bednarek and Caple 2012: 44). Superlativeness can be reflected linguistically in the usage of (1) large quantifiers; (2) adjectival intensifiers, comparatives and superlatives; (3) process verbs related to growth or escalation, e.g. *balloon, bolster*; as well as compositionally through repetitions, analogies and figurative expressions/chains, e.g. *as...as, again and again.*

Timeliness, according to Bednarek and Caple (2014), is built by establishing a close relation between the event and the moment of news publication through:

(1) indications of recency, mainly through verb tense and aspect, (2) time adverbials (note "breakthroughs" *of 2017*), or (3) references to ongoing process, e.g. *try, continue, more of...* . For example, science-oriented coverage claims to bring news of the *latest* development that either endorses or contradicts *previous* hypotheses (Molek-Kozakowska 2015), thus coinciding with novelty.

Some of the timely news items may additionally be marked for their possible impact (cf. the notion of "breakthrough" as an event that metaphorically *breaks or breaches insurmountable barriers* or *redirects or reverses the course* of scientific progress). Although Bednarek and Caple (2014) see realizations of the news value of impact in terms of (speakers') evaluations of significance or quantification of possible consequences, scientific journalism may well resort to other patterns of projecting relevance and impact through (1) conditionals, e.g. *if ever (before)* (2) modality and hedging, e.g. *had to be..., it easily was the most...* or (3) narrative e.g. *first...but then...* (Molek-Kozakowska 2015, 2017a).

The value of prominence, also known as eliteness (Bednarek and Caple 2014), should be taken as a default news criterion in the context of science coverage, which is a prestigious domain of activity. The discursive implementation of prominence (status or acclaim) can be additionally articulated through (1) various institutional status markers, including labels, titles and recognized names, e.g. *the Nobel Prize*; as well as (2) evaluations of *global* importance and descriptions of *historic* achievement. Indeed, the credibility of popular science journalism rests on representing information as emanating from elite academic sources, and thus as reliable (not fake) news, which is worthy of one's time and effort to get acquainted with.

That is also why, in order not to alienate readers who want to be knowledgeable about science-related issues, apart from news values, science journalism needs to offer rationalization values. Rationalization cues may include (1) authority appeals, which are endorsements or opinions collected from identified or named authoritative sources; (2) details and descriptions that explain more clearly relations between entities as causes leading to specific effects; (3) confirmations of pre-existing theories, known models or strong hypotheses; (4) exemplifications of general rules with particular cases; (5) problem-solution sequences in expositions, and (6) seemingly balanced arguments both for and against various alternatives (cf. Perez-Llantada 2012, Molek-Kozakowska 2017a). These logical and rhetorical strategies follow the rules of academic *logos* and increase the academic *ethos*, which is why they

often feature in accommodated science, where science-related issues are to be presented as relevant and attractive to non-specialists without compromising the scientists' credibility (Fahnestock 1986). Rationalization values are also constructed through adequate attribution of information (references to original publications), as well as by illustrating the applicability of science results (cf. proximization strategies – "how *you/we* can profit from this discovery" – cf. Molek-Kozakowska 2015). However, since implications and consequences of many scientific discoveries are not yet known, science coverage is likely to involve various degrees of epistemic modality thus mitigating the uncertainty by simply labelling, classifying or ranking a piece of scientific research as a "breakthrough" *ipso facto.*

3. Constructing a "breakthrough": results and illustration

The following table includes the results of coding the sampled articles (according to the "breakthrough" ranking of the discovery) together with the scientific discipline or domain they represent and with the principal reference to the original source of information. It is worth noticing that out of twelve original references, half are linked to *Science Magazine*'s earlier publications, which could be interpreted as a strategic self-promotion device.

The last two columns include the coding for news values and rationalization cues detected in each article in the course of multiple close readings of the synopses. Although each "breakthrough/breakdown" implies or presupposes novelty, superlativeness, timeliness, impact and prominence, the coding includes only the cases where news values were found to be explicitly constructed with stylistic choices. This is later illustrated with excerpts from the articles. The number of news values detected per article varies between one and four. In addition to news values, the texts have been annotated for explicit instances of rationalization values that contribute to legitimizing a given issue as a major scientific event or discovery and explain its position in the ranking list. The number of rationalization cues varies from three to all six.

To summarize, the most common news value identified was impact (9 instances), followed closely by timeliness and superlativeness (8 instances each), as well as novelty (7 instances). The value of prominence was explicitly constructed only three times; however, it is largely presupposed in such a ranking,

Table 1. Results of the coding of the sampled articles. Source: own elaboration

No.	Breakthrough (1-10) or breakdown (11-13) ranking	Principal scientific reference invoked	News values constructed with explicit stylistic choices	Rationalization values constructed with explicit stylistic choices
1	Cosmic convergence *astrophysics*	B. P. Abbott *et al*., GW170817: Observation of Gravitational Waves from a Binary Neutron Star Inspiral, *Physical Review Letters,* Vol. 119, p. 161101, 16 October 2017	novelty, superlativeness, timeliness, impact	authority, cause/effect, confirmation of theory, exemplification, problem/solution
2	Life at the atomic level *chemistry*	E. Stokstad and R. F. Service, A cold, clear view of life wins chemistry Nobel, *Science*, 4 October 2017	novelty, superlativeness, timeliness, impact	authority, exemplification, problem/solution
3	A tiny detector for the shiest particles *physics*	D. Akimov *et al*., Observation of coherent elastic neutrino-nucleus scattering, *Science*, Vol. 357, p. 1123, 15 September 2017	novelty, superlativeness, impact	authority, cause/effect, problem/solution, pros/cons
4	Deeper roots for *Homo sapiens archeology*	J. Hublin *et al*., New fossils from Jebel Irhoud, Morocco and the pan-African origin of *Homo sapiens*, *Nature*, Vol. 546, p. 289, 8 June 2017	superlativeness, impact	authority, confirmation of theory, exemplification,
5	Pinpoint gene editing *biotechnology*	H. Ma *et al.*, Correction of a pathogenic gene mutation in human embryos, *Nature*, Vol. 548, p. 413, 24 August 2017	novelty, superlativeness, timeliness, impact	authority, cause/effect, exemplification, problem/solution, pros/cons
6	Biology preprints take off *scientific communication*	J. Kaiser, Are preprints the future of biology? A survival guide for scientists, *Science*, 29 September 2017	impact, prominence	authority, exemplification, pros/cons
7	A cancer drug's broad swipe *medicine*	D. Le, *et. al.*, PD-1 blockade in tumors with mismatch-repair deficiency, *The New England Journal of Medicine*, Vol. 372, p. 2509, 30 May 2015	novelty, timeliness, impact	authority, cause/effect, confirmation of theory, exemplification, problem/solution, pros/cons

Table 1 contd.

No.	Breakthrough (1-10) or breakdown (11-13) ranking	Principal scientific reference invoked	News values constructed with explicit stylistic choices	Rationalization values constructed with explicit stylistic choices
8	A new great ape species *biosystematics*	A. Nater *et al.*, Morphometric, Behavioral, and Genomic Evidence for a New Orangutan Species, *Current Biology,* Vol. 27, p. 3498F, 20 November 2017	novelty	confirmation of theory, exemplification, pros/cons
9	Earth's atmosphere 2.7 million years ago *atmospheric chemistry/geology*	P. Voosen, Record-shattering 2.7-million-year--old ice core reveals start of the ice ages, *Science*, 15 August 2017	novelty, superlativeness	authority, cause/effect, confirmation of theory, problem/solution
10	Gene therapy triumph *medicine*	J. Mendell *et al.*, Single-Dose Gene-Replacement Therapy for Spinal Muscular Atrophy, The New England Journal of Medicine, Vol. 377, p. 1713, 2 November 2017	timeliness, impact	authority, cause/effect, confirmation of theory, exemplification, problem/solution
11	Trump and scientists: an epic estrangement *scientific policy*		superlativeness, timeliness, prominence	authority, exemplification, problem/solution
12	A bad year for cetaceans *oceanography*	E. Pennisi, The North Atlantic right whale faces extinction, *Science*, 7 November 2017	superlativeness, timeliness, impact	cause/effect, exemplification, problem/solution
13	#MeToo: sexual harassment in science *scientific community*	M. Wadman, Leaked documents expose long-standing gender tensions at Salk Institute, *Science*, 23 August 2017	timeliness, prominence	authority, exemplification, problem/solution, pros/cons

and thus needs not to be expressed or foregrounded with stylistic devices. As regards rationalization values, 11 out of 13 articles invoke authoritative sources – usually top scientific research institutions, laboratories or universities or their named representatives. The same number of articles (11) resort to giving specific exemplifications of the larger phenomena covered. It is important to note that the examples often rely on broader, yet not specialist, knowledge of the discipline. 10 articles follow a problem-solution script in at least one of the paragraphs, whereas 7 articles demonstrate the logical relations between causes (e.g. detecting genetic mutations) and effects (e.g. eliminating inherited disorders). A confirmation of a theoretical model is showcased in 6 articles (usually in hard sciences), while a discussion of both advantages and problems that the given scientific finding/issue at stake creates is included in another 6 articles (mostly on biomedicine and on how science should be done, communicated or applied).

The following sub-sections are devoted to the illustration of some of the characteristic stylistic choices that construe scientific findings as "breakthroughs" by reproduction of news values and rationalization cues. The stylistic choices were italicized and the examples were annotated for the principal lexical, grammatical or compositional maneuver applied (in square brackets). It needs to be noted that in some excerpts a few news values or rationalization cues may have converged, even though only one is specified. The examples are presented in the order of frequency and pervasiveness (of the categories identified in the sample (see the paragraph above).

3.1. News values

Impact tends to be constructed in a variety of ways, mainly through grammatical choices of tense and aspect, large quantifiers and modifiers, as well as (idiomatic, parallel, contrastive) sentence structures:

> By delivering near-atomic-resolution to structures *never seen before*, cryo-EM *is helping explain* decades of biochemical and genetic observations. (2)[3] [tense and aspect]
>
> Researchers pushed cryo-EM's *ability to tackle* large and small molecules, *solving the structures* of a red alga's gigantic light-harvesting complex and several small protein complexes that *were previously out of its reach*. (2) [verbs of ability, contrast]

[3] This number (henceforth) refers to the article in the ranking list featured in Table 1.

> Researchers announced a *major improvement* of a *nascent* technique, called base editing, to correct such point mutations, *not just* in DNA, but in RNA *as well*. (5) [modifiers, parallel structure]
>
> But preprint sharing in biology *took off* this year, as *thousands of* life scientists posted their unreviewed papers online and *funders threw their weight* behind this mode of scientific communication. (6) [idiomatic expressions of intensity, large quantifiers]

Superlativeness, as could be expected, is realized with numerical expressions, large quantifiers and superlative or comparative (adjectival) forms:

> The merger of two neutron stars captivated *thousands of observers* and fulfilled *multiple* astrophysical predictions. (1) [numerical expressions, large quantifiers]
>
> Instead, the researchers *pulled off the feat* with a portable detector that weighs about *as much as a microwave oven.* (3) [idiomatic expression, comparison]
>
> Researchers determined that the skull is a *startling* 300,000 years old – about 100,000 years *older* than fossils from Ethiopia that had held the record as *the oldest* widely accepted remains of *archaic* H. sapiens. (4) [emotion/evaluative adjectives, comparative/superlative forms]

Timeliness tends to be indicated with various time adverbials, which, in a given context, signify either recency or urgency:

> Scientists first detected such waves *just 27 months ago*, when the Laser Interferometer Gravitational-Wave Observatory (LIGO) sensed a space tremor. (1) [time expression of recency]
>
> *Within 11 hours*, several teams of optical and infrared astronomers had found a new beacon on the edge of the galaxy NGC 4993. (1) [time expression of speed/urgency]

Stylistic markers of novelty often take the form of lexical choices or phraseological clusters that relate to surprise or rarity. They stress scientists' creativity, innovativeness or ingenuity:

> Scientists around the world witnessed *something never seen before*: One hundred and thirty million light-years away, two neutron stars spiraled into each other in a spectacular explosion. (1) [perfective aspect]
>
> [Cryo–electron microscopy] is a *rare innovation* that earns science's top honor at the same time as its impact continues to mount. (2) [lexical choice of rarity and novelty]
>
> *This year*, physicists spotted the most elusive subatomic particles, neutrinos, pinging off atomic nuclei *in a new way.* (3) [adverbials of time and manner]

Prominence is signaled explicitly with adjectives or nominalizations, or indirectly through process verbs or such cultural connotators of prominence as references to elite countries, institutions or organizations:

> *Prominent* life scientists fanned out to persuade their colleagues that preprints speed the pace of science and help young investigators build a research record. Early this year, *organizations in the United States and the United Kingdom* issued policies encouraging preprint sharing, giving the practice a *major boost*. In April*, the Chan Zuckerberg Initiative*, announced an undisclosed investment in bioRxiv, *bolstering its position* as biology's most popular server. (6) [adjectival choice, verbs related to coming to prominence, reference to countries and institutions]

3.2. Rationalization values

Almost each article specifies either collective or individual sources that, through their authoritativeness, legitimize the framing of the discovery/issue as a "breakthrough":

> The explosion was easily the most studied event in the history of astronomy, with *3674 researchers from 953 institutions* collaborating on a single paper summarizing the merger and its aftermath. (1) [numerical expressions pertaining to vast academic consensus]
>
> *U.S. National Institutes of Health* set up a network of cryo-EM centers *around the country*, and some of the pioneers of the technique were awarded *the Nobel Prize in Chemistry*. (2) [reference to scope and institutional authority/recognition]
>
> Pioneered by David Liu, a chemist at *Harvard University*, base editing borrows from CRISPR, the "molecular scissors" that debuted as a *powerful lab tool* in 2012. (5) [institutional authority, previous acclaimed research]

To enable readers to follow accommodated science, articles in the ranking abound in exemplifications of general rules with particular cases:

> Supernova explosions of individual stars in *our Milky Way galaxy* should also produce detectable gravitational waves, which could help astrophysicists figure out exactly how the stars blow up. (1) [reference to known locations]
>
> This means that whether the cells turned cancerous *in the pancreas, the colon, the thyroid, or any one of a dozen other tissues,* they are riddled with mutations in genes that repair DNA. (7) [open listing]
>
> Researchers *are now using* infusions of AAV9 [harmless adeno-associated virus] carrying *other* genes to treat children with severe inherited brain disorders. (10) [extension of original therapeutic use]

Problem-solution sequences are characteristic rationalization cues in "discovery" narratives and presentations of results. They also feature in concluding paragraphs where applications of newly discovered mechanisms or new inventions are listed:

> Researchers pushed cryo-EM's ability to tackle large and small molecules, *solving the structures* of a red alga's gigantic light-harvesting complex and several small protein complexes that *were previously out of its reach*. (2) [narrative of overcoming limitations]
>
> Such small neutrino detectors *might someday help monitor* nuclear reactors, for example *to ensure* they are running according to nuclear nonproliferation regulations. (3) [infinitive of purpose]
>
> Chinese researchers demonstrated the power of base editing this year *by fixing a disease--causing point mutation* in human embryos. (5) [presentation of end results]

Cause-effect relations are typical stylistic devices of scientific *logos* and are replicated in popularization through explicit references to links between causes and effects or reasons/motivations and results of scientific work:

> More than 60,000 genetic aberrations *have been linked* to human diseases, and nearly 35,000 of them *are caused* by the tiniest of errors: a change in just one DNA base at a specific point in the genome. (5) [verb choice, passive voice]
>
> *One reason for* the estrangement is Trump's action on science-related issues: He *has renounced* the 2015 Paris climate accord, *rolled back* many environmental rules, and *called* for deep budget cuts at key research agencies. (11) [listing of reasons, perfective aspect]

The stylistic devices that pertain to the rationalization cue known as "confirmation of theories" include the choice of verbs that describe scientists' activities and that make use of narrative tenses:

> The blast *confirmed* several key astrophysical models, *revealed* a birthplace of many heavy elements, and *tested* the general theory of relativity *as never before* (1) [verbs denoting completed scientific activities]
>
> Hublin's team *thinks* the Jebel Irhoud people *were* part of a large, interbreeding population of early H. sapiens that *spread* across Africa 330,000 to 300,000 years ago and *evolved* into modern humans. (4) [narrative tenses for a likely sequence of events]

To achieve the impression of balanced, objective evaluation of a discovery, science articles sometimes include the discussion of both pros and cons of the research results. These might be realized as a section devoted to limitations, qualifications and criticisms of the scientific achievement reported on:

> But the amped-up scattering also *has a downside*: As physicists try to detect particles of cosmic dark matter with ever-more-sensitive detectors, the coherent scattering of neutrinos from the sun will become a source of interference. (3) [caveat for limitations]
>
> They never intended to implant the embryos, and the repair was *not always successful*, but the feat proved that base editing has what they called "tremendous potential." (5) [qualification]
>
> Many life scientists *aren't comfortable* sharing work that hasn't received peer reviewers' stamp of approval. Still, "It's amazing how rapidly things have changed," says *preprint advocate* and cell biologist Ronald Vale of the University of California, San Francisco. (6) [opposing stances]

4. Framing science as "breakthroughs": implications

According to Kitzinger, "framing refers to the process whereby we organize reality" (2007: 133). Hence, the term "frame" is used to explain how news items are most probably classified, interpreted and memorized. Framing analysis can enhance our understanding of purposes and consequences of journalistic or editorial practices, such as those related to agendas and hierarchies of importance, which have been studied here. The concept of framing also allows us to better consider the implications of this analysis, which consists in identifying how stylistic and rhetorical strategies contribute to representing some events as "breakthroughs" worthy of readers' special attention. This type of analysis of "breakthrough" frames in ranking lists is also a part of critical discourse analysis, as it reveals the hidden mechanisms through which certain news items are emphasized in the text to attract attention (Richardson 2007).

This is because, when the public does pay attention to specifically framed science news, the reporting can do a deeply ideological work (Entman 1993). For example, Kitzinger and Williams (2005) conducted a detailed linguistic analysis to illustrate how the framing of embryo stem cell research in British national press and televised reports in 2000 helped to mitigate doubts about a controversial biotechnological procedure known as therapeutic cloning. The media used "hype frames" that heralded innovation and breakthrough, whereas authority appeals highlighted the approving opinion of the therapy by the scientific community. Meanwhile, emotional appeals on behalf of the patients with incurable diseases foregrounded profits derived from the future possibilities of organ replacement. The analysts pointed to the fact that the stem cell regulations ultimately accepted by the UK government were largely compatible with the dominant assessments featured in the mainstream media. In

another study, Risbey (2008) showed that "alarmist," or catastrophic, frames related to ongoing global warming adopted by some outlets were much less mobilizing for the general population than "alarming" representations of scientific facts that actually enabled readers to rethink their everyday consumption and lifestyle choices.

It can be concluded that science news values and rationalization cues are applied by science editors in an effort to perpetuate the discursive oscillation between "the rhetoric of hope" and "the rhetoric of fear" (Kitzinger and Williams 2005), which keeps readers engaged in consuming more and more of science coverage. Sadly, it might be claimed that ongoing speculations about "breakthroughs" that both celebrate science and cause panic constitute what Jensen terms "a framing device that science journalists use to the detriment of a clear and coherent presentation of a controversial scientific development and its realistic implications" (2012: 44). Some "breakthrough" frames indeed seem to be strategically designed to motivate continuous superficial engagements with the science-related news rather than a deeper understanding and critical reflection on the role of science in society.

Finally, it can be hypothesized that "breakthrough" framing through stylistic maneuvering and generic exploitation of end-of-the-year ranking lists can result in displacing some alternative (more productive) framings, such as "risk" rather than "benefit," or "continuity" rather than "revolution" (cf. Molek-Kozakowska 2016). As shown above, the rationalization cue that relates to a fair discussion of both advantages and problems brought about by the discovery is exceedingly rare in the *Science* sample. At the same time, the claim that some types of discoveries are "breakthroughs" is not open to debate concerning their merits, required financial investments and relevance for humanity, at least not in the end-of-the-year ranking list.

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Constructing a "breakthrough": News values in Science Magazine's 2017 ranking of most important discoveries

The objective of this study is to conduct a stylistic analysis of the synopses publicized in the end-of-the-year ranking list of 2017 scientific "breakthroughs" from *Science Magazine.* The article provides a review of literature on science popularization (also known as science accommodation) and presents the typology of news values and rationalization cues that are used by editors to make science-related coverage both newsworthy and credible at the same time. The article lists the possible ways in which scientific findings can be stylistically constructed as "breakthroughs". The analysis consists in quantifying and illustrating the typical stylistic maneuvers for framing selected science-related issues as "breakthroughs." The article concludes with the implications of such constructions for the public understanding of science.

Keywords: *science popularization, journalism, news values, rationalization values*