Thinking
Out of the Box
in English Linguistics,
Language Teaching,
Translation and Terminology

Proceedings of the XXIX AIA Conference

edited by
Katherine Ackerley, Erik Castello, Fiona Dalziel,
Sara Gesuato, Maria Teresa Musacchio
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"Lexical verbs in a medical case-report wordlist", in *ASIALEX* 4, pp. 39-62 (in collaboration with Philippa Mungra); (2016) "Metaphors in the mirror: the influence of teaching metaphors in a medical education programme", in *CercleS* 6 (1), pp. 185-206.

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Bloody Sunday in Wikipedia", 2016). Recent articles and book chapters concern Data-Driven Learning ("Using web search from a corpus perspective with digital natives", 2019) and Corpus Stylistics ("Vertical and distant reading with Digital Natives. The case of *The Merchant of Venice*"). She has recently co-edited the reader *Culture and the Legacy of Anthropology* (Peter Lang 2020).

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Smith Review, vol. 13, London: Routledge and Taylor Francis Book, pp. 285-302; (2022) "Migration Discourse and the New Socially Constructed Meanings of the English Lingua Franca", in P.C. Leotta (ed.), Language Change and the New Millennium, European Scientific Journal, ESJ, 18 (18), pp. 33-49, Offices: Spain and Macedonia; (2020) "Fascist Terminology in English Lexicography: Considerations from the Merrian-Webster Unabridged and the Oxford English Dictionary", in Textus, XXXIII, 1, H. Béjoint and S. Nuccorini (eds), pp. 145-163, Roma: Carocci Editore.

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ON THE DEFINITORY CROSSROADS:
LEGAL, MEDICAL-SCIENTIFIC AND POPULARIZED DEFINITIONS OF
(HUMAN) GENE EDITING

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The study investigates the way in which the specialized unit of understanding of gene (genome) editing is conceptualized through definitions in bioethically relevant legal discourse, medical-scientific discourse of institutional publications and popularized media discourse. The research pursues the goal of analyzing existing definitions in these three areas in English, relying on the theory of definitions in terminology and terminography, and on function theory of lexicography. The analysis is carried out in a quantiqualitative vein, using methods of corpus linguistics for text search and data processing, and the combined paradigm of cognitive semantics and discourse analysis for the analysis of definitions. The findings identify a) a partial definitional coverage in the popular press, suggesting a reliance on some presumed knowledge; b) a lack of legal definitions unambiguously directed at gene editing, highlighting the need for the creation of new legal definitions of the technology; c) divergent definitional styles proposed by and for different users, which are translated into the prevalence of different information-based content and patterns across the corpora.

Definitions, gene editing, legal definitions, scientific definitions, popularized definitions

1. Introduction

When science advances and discovers new possibilities, concepts and technologies, language has to incorporate these changes within new terms and deal with notions that are not yet firmly established as part of shared knowledge. When a new term is introduced, it is imperative that all parties understand it in the same way. This is especially true when the term in question denotes a highly controversial new technology with a great and multifaceted

potential for change, such as gene editing. Discovered in 2012, this Nobel-winning[1] biotechnology has acquired multiple applications in plant, animal and even human modification at the genetic level. The technology was baptized as *gene editing* or *genome editing*, probably building on the conventionalized metaphor of genome as a book or a text (Mattiello 2019; Nelkin 2001; Nerlich and Hellstein 2004) that can now be modified (Nikitina 2019, 2020). Even though it has been widely discussed in various contexts, the term appears to be still lacking terminological stability. Scientists themselves frequently use both terms interchangeably with no clear preference for one or the other (Foong 2019: 376; Thompson 2015: 45). As a 2019 survey indicates (McCaughey *et al.* 2019: 39), experts emphasize the lack of linguistic clarity with naming and defining the technology (Wells and Joly 2017), though the technology has been widely popularized in mass media and is known to the public at large. Undoubtedly, terminological stability, along with the uniformity of interpretation of new terms, can be enhanced through clear and structured definitions. From a legal and bioethical point of view, definitions of new biomedical technologies play "a crucial role in the categorization of such entities and objects, and in the establishment of connections amongst them" (Garzone 2018: 10). From a medical-bioethical standpoint, the literature on definitions emphasizes that

> Definitions are important. They can serve as an impetus for changing practice, for introducing new programs and for working toward the allocation of more resources [...]. Moreover, the understanding of these concepts influences how medicine is practiced. (Kaasa 2001: 413)

In general, "there is concern that the science and innovation of genome editing is moving ahead of public understanding and policy" (Tuerlings 2019: 3; see also Nuffield Council on Bioethics 2016). Recent studies have called for an unconventional regulation of human gene editing, uniting a plethora of perspectives and a "broad societal consensus" (Lander et al. 2019: 165f; see also Hulburt et al. 2018; Saha et al. 2018). Currently, the definitions of gene editing in circulation are those created by medical professionals and the popular press, with very few legal definitions because a limited number of legislators have had time to register this latest technological progress, despite their understanding that "complex therapeutic products require precise legal definitions" (*Regulation (EC) No 1394/2007*: par. 3). As gene editing is complex and multifaceted, the absence of a standardized definition could preclude a general understanding and regulated practice of this technology. Research on coexisting definitions of the same concept in legal, medical and popular contexts (Armani 2017) suggests that the lack of a standardized definition, or

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[1]   The Nobel Prize in Chemistry 2020 was awarded to Emmanuelle Charpentier and Jennifer A. Doudna "for the development of a method for genome editing" (https://www.nobelprize.org/prizes/chemistry/2020/press-release/).

rather multiple understandings of a concept, could potentially jeopardize its legal acceptation, should a jury be asked to deliberate on a case connected with such a concept (Armani 2017: 213). As the recent events demonstrate, gene editing has already given rise to a number of legal cases (e.g. *ECJ Case C-528/16*) or cases with potential lawsuits (e.g. medical responsibility for the gene editing of human embryos with a subsequent birth of gene-edited twins in November 2018, see Nikitina 2021; Sergeev 2019). Therefore, the aim of this article is to focus on the convergent and divergent tendencies in legal vs. medical-scientific vs. popular definitions of gene editing with a view to identifying possible definitional strategies of gene editing and preparing the ground for future analysis of emerging interlinguistic and international codification of this technology.

2. Definitions

Defining is a fine art, which is often seen "as a never ending process having progress of both understanding and knowledge as such as its motive" (Temmerman 2000: 76). International Standardization Organization defines *definition* as a "representation of a concept by an expression that describes it and differentiates it from related concepts" (ISO 1087-1:2019, 3.3.1). In linguistics, the natural habitat of definitions, where such representation of concepts is studied, lies within the fields of lexicography and terminography. As terminography documents specialized lexicon of a specific subject field, domain or discipline (such as biomedicine and gene editing), this approach suits most the purposes of this study, although lexicographic research on definitions has also been consulted. In terminography, definitions function as "a form of expert knowledge representation, [...] setting up a dialogue with receptors" (Montero-Martínez and García de Quesada 2004: 266), and this is a valid starting point also from the knowledge dissemination perspective. Terminographers focus on the successful codification of expert terminological knowledge under a form of a micro-discourse reflecting terminological uses, communicative intentions and cognitive schemes (Montero-Martínez and García de Quesada 2004: 267).

Lexicographic research offers valuable inputs for this study, too. The functional theory of lexicography (Bergenholtz and Tarp 2003) posits that different definitional styles are proposed by and for different users, taking into account "what is needed to solve the set of specific problems that pop up for a specific group of users with specific characteristics in specific user situations" (Bergenholtz and Tarp 2003: 172). The concept of user needs/situations runs in parallel with the social situation where lexicographic needs appear (Bergenholtz and Tarp 2010). Following this theoretical framework, the definitional knowledge that appears in legal texts is bound to differ from that of the popularized press and of institutional scientific communication.

Legal definitions perform constitutive and regulatory functions (Palashevskaya 2017: 132) and pursue the goal of promoting clarity and achieving "a necessary degree of definiteness" (Thornton 1987: 54), also through the so-called "re-definitions" (Garzone 2018). Legal definitions are considered to be among the most challenging provisions to draft (Jopek-Bosiacka 2011: 16). Most frequently legal definitions are of a *nominal* type, i.e. they "focus on signs, and abstract the semantic dimension of such signs" (Garzone 2018: 16; cf. Hernández Ramos and Heydt 2017: 133; see also Robinson 1954). They can be *stipulative* or *lexical*. The former set "a certain meaning for a specific expression" following the drafter's decision "to use a specific term in a certain sense that may go beyond the definitions given in dictionaries and linguistic uses" (Hernández-Ramos and Heydt 2017: 133; see also Harris and Hutton 2007). The latter "attempt to ascertain the meaning of a specific linguistic expression and [...] are explained in dictionaries concentrating on the linguistic uses of a community of speakers" (Hernández-Ramos and Heydt 2017: 133; cf. Garzone 2018: 16). Obviously, legal definitions are not a panacea for indeterminacy of controversial concepts since a definition "*always* allows room for semantic divergence and hence misunderstanding" (Harris and Hutton 2007: 65), but their potential to reduce uncertainty is evident.

In specialized scientific discourse terminological definitions are not so pervasive, because "the meaning of certain expressions is taken for granted within the disciplinary community" (Gotti 2014: 18). In general, medical definitions tend to be less discrete than legal definitions (Truog 2018) as medical practitioners typically prefer descriptions rather than formal definitions. Biomedical and, specifically, bioethical terms and concepts "are commonly used but rarely and inconsistently defined" (Hui *et al.* 2014: 77). Hui *et al.* (2014: 86) when discussing the terms and definitions of end-of-life situations in circulation in medical publications emphasize the lack of clear conceptualizations and highlight the frequent recourse to the use of synonyms. In general – to the best of my knowledge – biomedical definitions have been underresearched from the linguistic point of view, with the exception of studies that focus predominantly on the content of definitions (Grego and Vicentini 2019; Hui et al. 2014; Namer and Baud 2007; Pastrana 2008).

Definitions found in the popular press "involve a far more limited use of specialized lexis" (Gotti 2014: 18). They frequently rely on metaphorical language (O'Keefe *et al.* 2015) and buzzwords (Bensaude Vincent 2014), which are used as synonyms for the term. In addition, and in stark contrast to medical-scientific and legal contexts, popularized definitions involve a certain degree of approximation and use such expressions as "a sort of", "a kind of", etc. to introduce highly specialized concepts (Gotti 2014: 19). Popularized definitions often act as re-definitions that *recontextualize* (Calsamiglia and

van Dijk 2004: 370) scientific knowledge adapting it to a new communicative situation in order to reflect the nature of popularizing scientific discourse and the expectations of its users, who "might be interested in a shorter and less dense definition" (Espinoza Anke 2013: 268) in comparison to a scientific one. Yet, "[s]hort definitions are always problematic because they cannot embrace a complex phenomenon in its totality" (Fuertes Olivera and Tarp 2014: 4), and the technology of gene editing involves a number of bioethically complex issues. In previous research I found the extensive use of imagery in the UK press (Nikitina 2019, 2020) representing the technology in an ideologically slanted way, which goes beyond mere terminological adjustments providing a social reading, and potentially interpretation suggestions, to the technology.

Linguistic literature abounds in different taxonomies of definitions, which essentially attempt to classify definitions by the type of information they contain, i.e. the so-called *information-based taxonomies* (Del Gaudio, Batista and Branco 2013; Sager 1990; Sierra, Alarcón, Aguilar and Barrón 2006) and by the pattern around which they are built, i.e. the so-called *pattern-based taxonomies* (Westerhout and Monachesi 2007) revolving around the grammar of definition sentences in dictionaries (Barnbrook 2002).

The information-based taxonomies are inspired by traditional logic and date back to scholasticism and Aristotle (Espinosa Anke 2013; Robinson 1954: 94ff; Sierra et al. 2006). The philosophical backdrop of categorization/conceptualization has inspired many modern works in cognitive semantics (Yang 2020: 16; cf. Talmy 2000; Temmerman 2000). To provide a linguistic reading of definitions, this study relies on the following information-based taxonomy refined and standardized by the International Standardization Organization (ISO 1087: 2019, ISO 10241 - 1: 2011, ISO 704: 2009).

1. Definitions *by synonymy* indicate an equivalent term in the definiens part to indicate that the defined term means the same or almost the same (partial synonyms) as some other word already known to the reader; e.g. "a catalogue is a list, register or complete enumeration". This category also includes denotative definitions, such as "CRISPR-Cas9, a gene editing tool".

2. *Intensional* definitions convey "the intension of a concept by stating the immediate generic concept and the delimiting characteristic(s)" (ISO 1087: 2019). In other words, these definitions define a term by providing its analysis, hence they are also known as *analytical*. Analytical definitions follow Aristotle's method of defining by *genus et differentia*, or a whole of parts, where *genus* stands for a bigger class within which the defined object falls and *differentia* names something that distinguishes the object from the rest of the class; e.g. "octagon is a polygon having eight sides".

3. Definitions *by implication* provide information about the term by describing its usage, function or application in a particular context (e.g. a diagonal "divides the square into two right-angled isosceles triangles");

4. *Extensional* definitions describe a term by enumerating its components, or "all species, which are at the same level of abstraction, or of all individual objects belonging to the concept defined" (Felber 1984: 163), e.g. "Nano-ear is made from a microscopic particle of gold that is trapped by a laser beam" (Espinosa Anke 2013: 271). Extensional definitions comprise *generic extensional definitions*, i.e. the specific concepts of a generic concept are listed under one criterion of subdivision on the same hierarchical level (ISO 1087: 2019, 3.3.4), and *partitive extensional definitions* that enumerate "all the partitive concepts of a comprehensive concept on the same hierarchical level" (ISO 1087: 2019, 3.3.5).

As concerns pattern-based taxonomies, their underlying idea is that "elements of meaning can be identified via the elements of pattern" (Hunston 2002: 154). In other words, a connection between pattern and meaning can be established by applying the notion of local grammar of definitions (Barnbrook 2002). As Barnbrook states, the language of definitions is a specific sublanguage following rules of a local grammar (Barnbrook 2002: 59). It is "a relatively restricted subset of English and [...] the nature of the restrictions allows the formulation of a specific grammar to describe its operation" (Barnbrook 2002: 72). Building on his previous work with Sinclair (Barnbrook and Sinclair 1995, 2001), Barnbrook (2002: 135f) proposes an extensive pattern-based classification of definitions as applied to the Collins COBUILD Student Dictionary dividing them into four groups with detailed subdivisions. Given the complexity of this taxonomy and space restrictions, this chapter will apply a more recent and simplified version of a pattern-based taxonomy, based on the notion of a local grammar of definitions, found in Westerhout and Monachesi (2007) and in Espinosa Anke (2013: 269). According to this simplified model, there are six types of patterns in definitions:

1. *Is*-definitions that introduce the definiendum by the verb "to be";
2. *Verb*-definitions that are introduced by any verb other than "to be";
3. *Punctuation*-definitions that use punctuation marks, such as commas, colons, brackets or dashes, to connect the term (headword) and definition;
4. *Pronoun*-definitions that do not mention the term but replace it with a pronoun exploiting anaphoric structures to identify the entity to which the pronoun is referring to;
5. *Layout*-definitions, exploring the structure and formatting of the document to identify definitions;

6.   *Unclassifiable* definitions.

For the analysis and where applicable, the above information-based and pattern-based classifications are supplemented with insights from the literature on legal, medical and popularized definitions overviewed above.

3. Materials and study design

Materials for the study comprise a three-part corpus, consisting of a) legal texts, including international conventions and treaties, statutes and legislatures and several court judgments (see Table 1), b) institutional-scientific statements and reports (see Table 2) and c) UK newspapers, including both tabloids and broadsheets, which came out during the 2017-2019 period (see Table 3). The corpus was collected using the search words "gene editing" and "genome editing" in the LexisNexis database and carrying out an additional web search.

The legal subcorpus contains international conventions and treaties with relevance to gene editing, as well as court judgments on this topic. The search with the exact keywords "gene editing" and "genome editing" did not produce many results – as there were no international treaties drafted after the discovery of CRISPR-Cas9, more general documents dealing with genetic alterations and modifications were included in the corpus. An additional search of English-language legislation and court cases was carried out to find specific mention of "gene editing" and "genome editing". The results are reported in Table 1 below.

Document name	Institution	Year	Abbreviation in this study
Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine: Convention on Human Rights and Biomedicine (European Treaty Series - No. 164)	European Community / European Union	1997	Oviedo_1997
Charter of Fundamental Rights of The European Union (2000/C 364/01)	The European Parliament, the Council and the Commission	2000	EUCharter_2000

Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC	European Parliament / European Council	2001	EUDirective_2001
Nagoya Protocol on Access to Genetic Resources and The Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity	United Nations, Secretariat of the Convention on Biological Diversity	2011	Nagoya_2011
Judgment of the European Court of Justice in Case C-528/16	European Court of Justice	2018	ECJ_2018
Judgment of the US Court of Appeals in the Case "University of California vs. Broad Institute, Inc"	United States Court of Appeals for the Federal Circuit	2018	USCourt_2018
The State of Washington House Bill 1990	Washington 66th Legislature - 2019 Regular Session	2019	WAHB_2019
The State of California Senate Bill 180	California 2019-20 Regular Session	2019	CASB_2019

TABLE 1. Legal subcorpus

The institutional-scientific publications include 16 documents, published by international bodies between the end of 2015 and 2019 (see Table 2). Most documents were solicited by the lack of clear regulations on gene editing and the absence of international legal documents. They pursue the goal of clarifying the issue and provide recommendations for governance.

Document name	Institution	Year	Abbreviation in this study
Statement on genome editing technologies	Committee on Bioethics (DH-BIO), Council of Europe	2015	DH-BIO_2015
On Human Gene Editing: International Summit Statement	Organizing Committee for the International Summit on Human Gene Editing	2015	ISHGE_2015
Genome editing: an ethical review	Nuffield Council on Bioethics	2016	NCB_2016
Statement on Gene Editing	European Group on Ethics in Science and New Technologies (EGE)	2016	EGE_2016
Human genome editing in EU. Report of a workshop held on 28th April 2016 at the French Academy of Medicine.	Federation of European Academies of Medicine (FEAM)	2016	FEAM_2016
Advanced Gene Editing: CRISPR-Cas9	Congressional Research Service (CRS) Reports	2017	CRS_2017
Human Genome Editing: Science, Ethics, and Governance	Committee on Human Gene Editing: Scientific, Medical, and Ethical Considerations, National Academies of Sciences, Engineering, and Medicine	2017	NASEM_2017
The use of new genetic technologies in human beings (Recommendation 2115)	Parliamentary Assembly, Council of Europe	2017	PACE_2017

Genome editing: scientific opportunities, public interests and policy options in the European Union. EASAC policy report 31	European Academies Science Advisory Council (EASAC)	2017	EASAC_2017
The application of Genome Editing in humans. A position paper of FEAM – the Federation of European Academies of Medicine.	Federation of European Academies of Medicine (FEAM)	2017	FEAM_2017
Statement by the Group of Chief Scientific Advisors: A Scientific Perspective on the Regulatory Status of Products Derived from Gene Editing and the Implications for the GMO Directive	European Commission	2018	EC_2018
At a glance: What if gene editing became routine practice?	European Parliament Research Service, Scientific Foresight Unit (STOA)	2018	EPRS_2018
Genome editing and human reproduction	Nuffield Council on Bioethics	2018	NCB_2018
Statement by the Organizing Committee of the Second International Summit on Human Genome Editing	Organizing Committee of the Second International Summit on Human Genome Editing	2018	ISHGE_2018
Detection of food and feed plant products obtained by new mutagenesis techniques	European Network of GMO Laboratories (ENGL)	2019	ENGL_2019

Background Paper Governance 1 Human Genome Editing	WHO Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing	2019	WHO_2019

TABLE 2. Institutional-scientific subcorpus

The popularized texts were selected among the UK and the US newspaper publications in the period 2017-2019 using search parameters "gene editing" or "genome editing". The newspapers were selected based on their large accessibility to general public. The broadsheet newspapers featured *The Times* (London), the *New York Times*, the *Independent* (UK) and the *Washington Post*. The tabloids selected were *Daily Mail / Mail Online*, *HuffPost* (US edition), the *Sun* (and the *Sunday Sun*) and the *Mirror* (including the *Sunday Mirror*). Every newspaper is equally represented in the corpus by twelve articles, four articles per year, which were randomly selected from the general results of the search carried out in the LexisNexis database and in the archives of separate newspapers.

Newspaper title	*Newspaper type*	*Number of articles*	*Abbreviation in this study*
The Times (London)	Broadsheet	12	BrTL
The New York Times	Broadsheet	12	BrNYT
The Independent	Broadsheet	12	BrTIn
Washington Post	Broadsheet	12	BrWP
Daily Mail / Mail Online	Tabloid	12	TbMO
HuffPost	Tabloid	12	TbPBN
The Sun	tabloid	12	TbTS
The Mirror	tabloid	12	TbTM

TABLE 3. Popularized subcorpus

The length of texts within single subcorpora varied significantly (e.g. compare an international convention and a newspaper report), hence it was decided to focus only on the extracted definitions, without counting the other parts of the texts. All definitions were extracted manually at the close reading stage from the "Definitions" (or analogous) sections in the documents featuring such sections or from the introductory part of the texts where the concept was announced and explained. The final corpus, reported in Table 4, features definitions of gene editing and genome editing as a primary focus, as well as some definitions of CRISPR-Cas9 as the main type of gene editing technology in use over the period analysed.

	Legal	*Institutional-scientific*	*Popularized*
Tokens in definitions	1,596	1,556	1,450
Number of definitions	15 (5)	37	55
Number of texts	7	16	96

TABLE 4. Corpus composition

The analysis provides a quantitative overview of the main definitional types, both pattern- and information-based, within single subcorpora. All definitions are manually selected, sorted and assigned the respective categories. In order to cater for differences in the number of definitions identified in each subcorpus, all quantitative data are expressed as percentage. Patterns and preferences pointing to a given definitional style for different user profiles and social contexts can be discovered. Next, a discourse analytical perspective is adopted to analyse the tendencies identified from the qualitative standpoint. Specifically, the framework of cognitive semantics (Felber 1984; Temmerman 2000) is applied to assess how meaning is constructed and how knowledge is represented in the definitions. The traditional theory of definitions (see Section 2) forms the general framework for this study and is supplemented by Temmerman's (2000: 122) "template for the description of units of understanding". Temmerman (2000) analyses the language of the life sciences and proposes the idea of "units of understanding" to emphasize that definitions can be provided also to prototypical structures, such as "biotechnology". For Temmerman (2000: 74f) units of understanding possess a prototype structure, may vary in time and can be explained as "categories of understanding" based on cognitive models. In this study, the definitions of a unit of understanding *gene/genome editing* are assessed for the convergent and divergent semantic fields and categories that are better explained in the following sections.

4. Findings and discussion

4.1 General trends

An overview of materials identified several remarkable trends. First, whereas all institutional-scientific and legal texts contained definitions, only 57% of newspapers featured them. Can it be construed as a certain knowledge presumption? Do reporters consider it sufficient to nominate gene editing without giving its definition? A recent demographic study (McCaughey *et al.* 2019: 39) on the awareness of gene editing conducted in 185 countries in 2015 showed that it was unknown to 12.1% only of respondents. Still, lack of standard codification and certain sensationalism of news coverage reporting on gene editing (Nikitina 2020) would call for a higher definitional clarity.

Second, there were very few legal definitions. This reflects the gap in modern regulation predating the appearance of CRISPR-Cas9. In fact, there were only two US bills drafted in 2019 in California and Washington and one 2018 judgment of the United States Court of Appeals for the Federal Circuit (see Table 1) that operated unambiguously with the new terms "gene editing", "genome editing" or "CRISPR-Cas9". Out of fifteen legal definitions applied to regulate gene editing, ten did not use these terms at all. Instead, the so-called interpretive approach was implemented using another *genus* of a superordinate type to define gene editing, such as "mutagenesis", "intervention on the human genome", "eugenic practices", "genetic modification" and "gene therapy", frequently leading to potentially imprecise generalizations. Example (1) quotes the 2018 ECJ judgment in Case C-528/16 dealing with a gene editing case in agriculture.

> 1) On those grounds, the Court (Grand Chamber) hereby rules:
> 1. Article 2(2) of Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC must be interpreted as meaning that *organisms obtained by means of techniques/methods of mutagenesis constitute genetically modified organisms* within the meaning of that provision[1]. [ECJ_2018]

As emerges clearly from the quote, gene edited organisms are equalled to genetically modified organisms based on the use of an umbrella *unit of understanding* or a *collective term* (Temmerman 2000: 75) "mutagenesis". At the same time, the definition of mutagenesis found in the institutional-scientific corpus shows that there are several subtypes of mutagenesis, and gene editing refers to a subtype of the directed mutagenesis only, as example (2) below shows.

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[1]   Emphasis is added in all examples.

2) Mutagenesis - is a process by which the genetic information of an organism is changed resulting in (a) mutation(s). Random mutagenesis techniques are based on using irradiation or chemical treatment of organisms or cells to generate random mutations. *Directed mutagenesis techniques, including genome editing, allow for making site-specific mutations in a targeted manner.* [EC_2018]

Although both documents were drafted in 2018, these examples show that the legal drafter was constrained by the use of pre-existing legal documents, which led to a much-disputed judgment (Case C-528/16). These observations confirm the lack of clear regulatory framework which would unequivocally identify gene editing, already discussed by legal scholars (Foong 2019; Hitchcock 2016; Sergeev 2019). As many institutional-scientific reports were drafted in 2018-2019 and were actually solicited by governments, it is reasonable to expect that a more updated legislative framework is about to be produced and will probably tie into the definitions of gene editing found in these scientific documents.

4.2 Definitional styles

After the manual sorting and classification, all definition types were counted using Excel spreadsheets and then converted into percentages in relation to the general number of definitions within the single subcorpora, in order to make the data comparable. Tables 5 and 6 below report these results.

Definition type	Legal	Institutional-scientific	Popularized
definition by synonymy	6%	0%	13%
intensional definition	31%	38%	29%
definition by implicature	13%	16%	37%
extensional definition	12%	5%	4%
extensional + implicative	6%	11%	0%
intensional + implicative	0%	13%	13%
intensional + extensional	13%	10%	0%

intensional + extensional + implicative	19%	14%	0%
synonymous + extensional	0%	3%	0%
synonymous + implicative	0%	0%	4%

TABLE 5. Information-based classification of definitions

	Legal	*Institutional-scientific*	*Popularized*
is-definition	25%	33%	9%
punctuation definition	0%	30%	18%
verb definition	75%	32%	57%
pronoun	0%	5%	2%
unclassifiable	0%	0%	14%

TABLE 6. Pattern-based classification of definitions

Several clear trends are observable in the tables above. First, legal and institutional-scientific texts rely predominantly on the intensional type of definitions. These are illustrated by examples (3) and (4) and will be further analysed in the next subsection.

3) Gene editing – also called genome editing, is a group of mutation technologies that allow modification of genetic information by adding, removing, or altering DNA sequences at a specific location in the genome in a targeted way. [EC_2018]
4) For purposes of this section, "genome editing" means the use of biotechnological techniques to make changes to specific DNA sequences in the genome of a living organism.[WAHB_2019]

In popularized texts the prevalent model is definition by implication (37%, see example (5)), followed by analytical (29%, see example (6)) and the combination of these two models (13%, see example (7)). A twofold focus on the analytical and implicative aspects of definitions in popularized texts is remarkable as newspapers not only describe what gene editing is, but also – in most cases –

highlight what gene editing does or can do, creating a more operationalized perception of the technology. This trend is substantiated through the persistent use of verb-definitions in newspapers (57%), where recurrent verbs include *to allow, to refer, to include, to comprise*, and also some light verb structures such as *to make it possible.*

> 5) gene-editing tools such Crispr-Cas9 *allow* scientists to reach into a crop's DNA and increase its yields, hardiness or nutrient level. [Times_2018]
> 6) "germline" gene editing — alterations in gamete cells or embryos that will be passed down to future generations. [HuffPost_2018]
> 7) CRISPR technology *is* a simple yet powerful tool for editing an animal's genomes. It *allows* researchers to easily alter DNA sequences and modify the function of a gene. Applications *include* correcting genetic defects and preventing the spread of diseases. CRISPR (pronounced "crisper") is shorthand for CRISPR-Cas9. CRISPRs are specialized stretches of DNA. The protein Cas9 is an enzyme which acts like a pair of scissors, capable of cutting strands of DNA. This process *allows* for the manipulation of genes or what has become known as editing. [The Sun_2019]

Legal and institutional-scientific texts also frequently rely on hybrid solutions, where different definitional models are combined. For instance, in (8) a classical analytical definition is followed by the extensional one. Similarly, in (9) a combination of analytical, extensional and implicative elements is found. A possible explanation could be offered by a different social and communicative context, where the primary goal is to inform the stakeholders in a detailed way and to provide more all-encompassing definitions, which are also typically longer than the definitions aimed at the profile of newspaper readership.

> 8) What we will refer to as 'genome editing' is the practice of making targeted interventions at the molecular level of DNA or RNA function, deliberately to alter the structural or functional characteristics of biological entities. These entities include complex living organisms, such as humans and animals, tissues and cells in culture, and plants, bacteria and viruses. [NCB_2016]
> 9) "Gene therapy kit" refers to a product that is sold as a collection of materials for the purpose of facilitating gene therapy experiments, including, but not limited to, a system for the targeted cutting of DNA molecules, such as type II clustered regularly interspaced short palindromic repeats (CRISPR), associated proteins (CRISPR-Cas) systems, including CRISPR-Cas9, as described in Regents of University of California v. Broad Institute, Inc. (2018) 903 F.3d 1286. [CASB_2019]

Finally, the use of synonymous definitions (10; 11) is more pronounced in newspapers compared to the other two corpora. These definitions also tend to be the shortest, which suits the typical space limitations in a news report.

> 10) The treatment for both conditions involved a high-precision *gene-editing tool called Crispr-Cas9.* [Times 2019]
> 11) He Jiankui said in November that he used a *gene-editing technology known as CRISPR-Cas9* to alter the embryonic genes of twin girls. [The Mirror_2019]

4.3 Intensional definitions across the corpora

As intensional, or analytical, definitions are the most prominent type of definitions across the subcorpora, these are addressed here in further detail. Since there are only five legal definitions featuring the exact terms under analysis, the present section examines predominantly intensional definitions in the other two corpora. Intensional definitions follow the *genus* and *differentia* model, where a "definition indicates the superordinate term and the necessary and sufficient characteristics which delimit the concept from related concepts" (Temmerman 2000: 76). Interestingly, institutional-scientific and popularized texts present both convergent and divergent strategies in lexical choices for both the *genus* and *differentia.*

The most common *genus proximum* in scientific publications and newspapers is represented by the category *technique(s)* or *technology(ies).* This category is often pre-modified (e.g. "a group of mutation techniques") or post-modified ("technique of directed mutagenesis") in scientific publications. In newspapers, it is frequently associated with evaluative adjectives ("miraculous new biological technique", "a pioneering field in biotechnology"). Consequently, although the superordinate term used is the same, the perception created by modifiers is different in that it seems to be adapted to the preconceptions or expectations of the recipients.

Scientific texts also make recourse to the semantic field of alteration as an umbrella unit of understanding (Temmerman 2000: 75). The examples would include such phrases as "altering genetic sequences", "making alterations to" and "the deliberate alteration of". Interestingly, no or little mention of agents to enact these modifications follows in stark contrast to popularized discourse which mentions explicitly such agents, with frequently evaluative modifiers. Finally, scientific texts employ some mixed and abstract solutions, such as "practice of making targeted interventions", "use of a modified editing enzyme" and "system".

For newspapers, on the contrary, a frequent umbrella unit of understanding is represented by physical objects, such as "tool" (the most frequent), "molecular machine" and "molecular scissors". Other metaphorical representations are employed, too, such as "word processor for the code of life", probably to make this topic more interesting. The choice to represent the technology as a physical object could be construed as a paradigm shift, because an abstract concept is presented through an operationalized image of a tool, which has a semantic component of high availability. Finally, newspapers tend to conceptualize gene editing via other known technologies, such as "a form of genetic engineering", "treatment", "medical research" and "cellular surgery". This reflects the popularized nature of journalistic texts, aimed at making specialized knowledge accessible and comprehensible to varied groups of

non-specialists. Indeed, when surveys look at the public's familiarity with the subject (e.g. McCaughey *et al.* 2019), the phenomenon is often circumscribed to similar approximate units of understanding.

5. Conclusion

This study pursued the aim of exploring the definitional aptness of the new Nobel-winning biotechnology of genome editing in three different contexts, building on the premise that the transfer and codification of knowledge could potentially involve some kind of transformation or shifting of focus according to the social context and user profiles. The study uncovered a definitional gap in the legal field, lagging behind with an unambiguous codification of gene editing and leaving legal practitioners at a definitory crossroads, where an interpretive approach or non-legal sources should be used for definitions of a very real technology. Consequently, the present overview of the types and definitional strategies used in the existing legal, medical-scientific and popularized definitions may be useful for further research on upcoming legal definitions of gene editing.

In confirmation of previous research, this study has illustrated how different user profiles and social contexts called for or resulted in different definitional styles of gene editing. The divergence in length and detail could be well imposed by the discursive practices, but the similarities and discrepancies in style, including the information-based type and pattern, seem to be noteworthy in terms of knowledge transformation. Genome editing tended to be defined most frequently in an analytical way in all three contexts, following the most classical definitional model. Yet, the prominence of hybrid types in legal and institutional-scientific texts marked the drafters' effort to codify the complexity of this phenomenon, reflecting the multiple facets of this unit of understanding.

Scientific publications offered more abstract and technical content with nominalized constructions and deverbal nouns revolving around the semantic field of alteration, with no or little mention of the actors involved. Newspapers, on the other hand, along with traditional analytic definitions, proffered a strong orientation towards definitions by implication, which brought gene editing from an abstract to a concrete and material plane and focused on what gene editing did rather than what it was in addition to the operationalized representation of the technology as a tool, potentially empowering a number of actors. Such a slant occurred against a background of partial definitional coverage by newspapers, where only 57% of publications offered a definition, while the others relied on some presumed knowledge of the technology. Finally, the predominance of verb-based patterns highlighted the hands-on nature of

the technology, marking a paradigmatic shift in talking about genome. The lack of existing legal definitions limited the comparative contribution of this paper to the investigation of intra- and inter-specialist communication. Future research on legal definitions of gene editing should supplement these findings to arrive at more generalizable data.

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