Dictionaries of Science as Participants in the Scientific Knowledge Economy

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY

Olga Menagarishvili

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Dr. Bernadette Longo, Adviser

August 2012

Acknowledgements

I would first like to thank my adviser, Dr. Bernadette Longo, for her patient support and wise guidance over the course of this project. I also want to thank my committee (Dr. Lee-Ann Kastman Breuch, Dr. Richard Graff, and Dr. Michael Hancher) for providing helpful feedback from their areas of expertise.

Secondly, I thank my family for their constant support and encouragement. I am forever grateful to my parents, Vladimir and Svetlana Menagarishvili, for believing in this project from the start, and to my husband, Maxim Chapovalov, for helping me get through the most difficult phases of writing.

I also appreciate the support of my fellow graduate students. In particular, I would like to thank Josh Welsh for his feedback on drafts of this dissertation, Merry Rendahl for her interest in my dictionary project, and Shuwen Li for her emotional support.

Finally, this dissertation would not have been possible without a Warren N. Cordell Research Fellowship that provided funds for conducting research in the Warren N. and Suzanne B. Cordell Collection of Dictionaries, the largest collection of dictionaries in the world.

Dedication

This dissertation is dedicated to my family.

Abstract

The purpose of this dissertation is to examine how the first dictionary of science that appeared in English (*Lexicon Technicum: or, an Universal Dictionary of Arts and Sciences* by John Harris) and one of the most recent dictionaries of science published in English (*McGraw-Hill Dictionary of Scientific and Technical Terms*) participate in the scientific knowledge economy. In order to answer that question, the study analyses the dictionaries from two perspectives: (1) as participants in knowledge making and (2) as products of capitalism. The model of production-consumption cycles is used, which is the extended version of Latour's model of knowledge accumulation, to consider dictionaries of science from both perspectives. The methodology combines *lexicography* (the science of dictionary-making and dictionary criticism) and *cultural studies* (the approach that focuses on the questions of power and culture and, therefore, allows one to discuss "knowledge legitimation within cultural contexts" (Longo, *Approach* 112). I am using lexicographic archaeology, which is one of the standard lexicographical methods for the comparison of different versions of the same dictionary. At the same time, I am extending the traditional lexicographic analysis by applying a cultural studies approach and using the cultural analysis of the front matter of each edition of a dictionary and employing production-consumption model, which is the discussion of how each dictionary functions in the model of production-consumption cycles.

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction

"Webster's dictionary defines *x* as *y*." For someone who teaches writing, this sentence, which often introduces a student's essay, probably sounds very familiar. What does it tell us about dictionaries?

Dictionaries are important objects of study because they exercise power as they assign value to knowledge. For centuries, the knowledge found in dictionaries has been considered to be more authoritative and "valuable" than the knowledge not included in these books. In this way, dictionaries have been dictating what knowledge is valuable and trustworthy (the knowledge found in dictionaries) and what is not (the knowledge omitted by dictionaries). However, because dictionaries are often viewed as mundane documents, their power is invisible, which makes them even stronger.

The ability to transform knowledge into value has been identified as one of the most important social functions of scientific and technical communication (Longo xi). Therefore, it is important to make the hidden mechanisms of transformation of knowledge into value visible. It is crucial to explore dictionaries of science and technology as the artifacts of scientific communication that have been playing an important role in creating and stabilizing scientific and technical knowledge, but that have not been given much attention by researchers.

I will now discuss the definition of "a dictionary" used in this study. Traditionally, dictionaries are viewed as reference works that describe words whereas encyclopedias are reference works that describe things. However, this difference has been much debated in lexicographic literature (see, for example, Béjoint 36-38; Eco, *Metaphor* 255-56; Eco, *Semiotics* 46-86; Frawley, *In Defence* 53-61; Haiman, *Dictionaries and*

Encyclopedias 329-57; Haiman, *Dictionaries and Encyclopedias Again* 354-55; Hancher 22; Tsohatzidis 395). For the purpose of this study, I define dictionaries as reference works that have the word "dictionary" in the title.

The main question the study is intended to answer is how the first dictionary of science that appeared in English (*Lexicon Technicum: or, an Universal Dictionary of Arts and Sciences* by John Harris) and one of the most recent dictionaries of science published in English (*McGraw-Hill Dictionary of Scientific and Technical Terms*) participate in the scientific knowledge economy. Because the major theoretical model used in the study is the extended version of Latour's model of knowledge accumulation, namely, the model of production-consumption cycles, and because dictionaries are the artifacts under study, a combination of a cultural study and a lexicographical study is used as methodology, and the methods include cultural analysis, lexicographic archaeology, and production-consumption model.

The findings are significant for scientific and technical communication for several reasons. First, this study makes visible hidden mechanisms that transform knowledge into value and explores the artifacts of scientific communication that play an important role in creating and stabilizing scientific and technical knowledge, but that have not been studied in detail. Second, the study proposes to modify one of the accepted theoretical models (Latour's model of knowledge accumulation) that have been used in the field. Third, the dissertation is based on a new methodology that has not been employed by researchers studying scientific and technical communication. By combining lexicography and cultural studies, I hope to advance both areas, introduce a new methodology for studying scientific and technical communication, and, thereby,

extend our knowledge of scientific and technical communication. Finally, the study contributes to our general understanding of how knowledge has been made in our society and who creates that knowledge.

Chapter 2: Literature Review

In order to provide the context for the study, I will first discuss the views on the cultural work done by dictionaries in general and then focus on the issues that have been studied in connection with dictionaries of science and technology in particular.

As cultural objects, dictionaries perform several types of cultural work. First of all, they have the ability to influence knowledge legitimation as powerful tools for education. Their connection with education is obvious from the very first glossaries created by monks for self-education (Jackson 31; Landau 37), the "hard word" dictionaries that were supposed to help women and children learn "difficult" words (Béjoint 94), and dictionaries of the seventeenth and the eighteenth centuries created in the Academies (Landau 48) to modern learner's dictionaries (Jackson 129). In this sense, dictionaries are very similar to textbooks as they have become almost emblematic of education: an open monolingual dictionary on a special stand can be found in almost any library in the United States. Because of this link with education, dictionaries have become "guardians of absolute and eternal truth" (Béjoint 122) and powerful tools for legitimizing certain types of knowledge.

Also, dictionaries create what Anderson calls "imagined communities" that can be defined as communities consisting of people who "will never know most of their fellow-members, meet them, or even hear of them, yet in the minds of each lives the image of their communion" (6). Such communities are present in our lives even though

most of the time we are unaware of them, and this invisibility, perhaps, makes imagined communities even more powerful.

Dictionaries participate in creating imagined communities and in knowledge legitimation in these communities in three ways. First, dictionaries create imagined communities as artifacts of print. As Anderson explains, "the development of print-as-commodity is the key to the generation of wholly new ideas of simultaneity" (37). He gives an example of newspapers that are published daily and read on the same day. This creates imagined communities because "each communicant is well aware that the ceremony he performs is being replicated simultaneously by thousands (or millions) of others of whose existence he is confident, yet of whose identity he has not the slightest notion" (35). Newspapers are, of course, an exterme form of a printed book in terms of simultaneity; however, new editions of popular dictionaries are often consumed very quickly, which creates imagined communities that get access to the same information at the same time.

Second, dictionaries are always closely connected with language, which is often used as a basis for creating imagined communities of those who speak this language. For example, Anderson points out that "the lexicographic revolution" that took place in the nineteenth century in Europe, "created, and gradually spread, the conviction that languages (in Europe at least) were, so to speak, the personal property of quite specific groups – their daily speakers and readers – and moreover that these groups, imagined as communities, were entitled to their autonomous place in a fraternity of equals" (84). Kernan explores the close connection between a dictionary and the language it describes and argues that for some people, a dictionary often becomes the language, so that for

them, “language is what a dictionary makes it, a limited number of ‘real’ words ordered alphabetically, with correct pronunciations, orthography, derivations, and a limited range of meanings” (185). Béjoint calls dictionaries “patriotic emblems” and writes that dictionaries are “the rare objects that can materialize the existence of a language, and hence of a nation, acting as a symbol of the unification of a community” (138). Indeed, other books are written in particular languages as well and, thus, create certain imagined communities of those who could read them; however, dictionaries are not only written in a certain language, but also describe this language and provide such types of linguistic information as spelling, pronunciation, meaning, usage, etc. In other words, unlike many other books, dictionaries represent language in two different ways, and because language often creates imagined communities, it is obvious that dictionaries are very influential in this area.

Third, dictionaries are powerful in forming imagined communities through standardization of a language signaling that members of this group use or should use the language the way that is described in the dictionary. For example, when Harris describes “black-and-white” lexicography, which is an old prescriptive approach to dictionary-making, he points out that one of its characteristics is that it “takes it upon itself to pronounce authoritatively on the rights and wrongs of usage” (935). This requires a separate discussion of prescriptivism and descriptivism in lexicography.

One of the topics discussed in literature is the issue of prescriptivism vs. descriptivism in dictionaries. Traditionally, there have been distinguished two approaches to dictionary making: the descriptive approach that focuses on how the language is used and the prescriptive approach that emphasizes how the language

should be used.

At present, the descriptive approach is the guiding principle for the majority of dictionary makers. As Norman puts it, "lexicography has in recent decades become markedly more descriptive and less prescriptive as a result of both changing sociolinguistic attitudes and the development of computerized corpus analysis" (259). According to Landau, "all competently done dictionaries must be based on usage" (32) and, thus, be descriptive. Prescription, on the other hand, is viewed as "impossible to distinguish from bias. Any preferred usage necessarily reflects the educational and cultural background of the editor making such a judgment" (Landau 32).

However, it is not as simple as that. First, Hartmann and James write about the impossibility of compiling a truly descriptive dictionary: "It is probably impossible to compile […] a truly accurate, comprehensive descriptive dictionary of a language" (xi). Béjoint supports this point of view and emphasizes that "it is partly true that all dictionaries are prescriptive since a dictionary is a book that one consults, in which one tries to find answers" (101). He also writes that "the distinction between descriptive dictionaries and prescriptive dictionaries is much clearer in the declarations of lexicographers than in the reality of the dictionaries themselves" (101). Finally, Bergenholtz points out that the term "descriptive" relates to the empirical basis of the dictionary, and the term "prescriptive" to the purpose of the dictionary (namely, helping with text production and affecting usage) (65). In other words, one of these terms is connected with the relation of the dictionary to the empirical basis whereas the other – with the function of the dictionary. Hence, these terms present a false contrast.

Moreover, according to current literature, the general public stays conservative and expects the dictionary to be prescriptive. Hartmann and James write that "public attitude in our day" can be described as "the dictionary is supposed to represent some form of final authority in matters of lexical meaning and use" (ix). Béjoint agrees with this and points out that "the normative ideal is still very present among the public, and it is one of the main reasons why people buy general-purpose dictionaries" (120). Therefore the dictionary "is still often seen as the repository of linguistic 'truth' as opposed to actual usage. For many users, what the dictionary contains is "more divine than human in essence" (122). Morton goes even further and connects the prescriptive and descriptive […] as "the difference between dictionary makers, who take their guidance from the way language is spoken and written, and dictionary users, who hanker for an authority to answer their questions according to rules governing the proper use of language" (7). Modern dictionary makers may try to create descriptive reference works, but dictionary users may consider all dictionaries to be prescriptive. In other words, any dictionary is viewed as a book containing the rules of the language use intended to be used by the imagined community of speakers of a certain language.

Another cultural issue discussed in current literature is the role played by ideology in dictionaries. This topic has been studied using material from dictionaries in a number of languages. For example, Ezquerra analyses political considerations in Spanish dictionaries. According to him, "the dictionary is a piece of work of social interest for several reasons: it is the depositary of the wisdom of a certain period of collectivity; users follow it, as it preserves the norm; it has a didactic character since it communicates knowledge and explains the unknown, etc. And, as any piece of work in

which has social implications, it is also the result of an ideology – or the ideology" (143). Ezquerra further gives several examples of royal interventions and political decisions in Spanish dictionary-making and analyses dictionaries as ideological tools.

Farina also discusses the connection between dictionaries and ideology focusing on a Soviet dictionary. She considers the influence of pseudo-Marxist theories of Nikolai Marr on the *Dictionary of Modern Standard Russian*, which was published from 1948 to 1965. Farina writes that it is important "to examine Marr's life and work, in order to understand how he influenced Soviet linguistic and in particular lexicography, as well as Soviet culture and society" (154).

Another study that connects ideology with dictionaries is Wierzbicka's article "Dictionaries and Ideologies: Three Examples from Eastern Europe." In this article, Wierzbicka analyzes three lexicographic definitions from three Eastern European dictionaries (a German, a Soviet, and a Polish one) in order to find out how the dictionary's editors dealt with ideological difficulties that were presented by the word "either because its meaning is 'politically incorrect,' that it reflects an outlook incompatible with the official communist ideology, or because it is politically sensitive, and can be used as a potent ideological tool in both desirable and undesirable political contexts" (181).

Marello continues the conversation about ideology and lexicography. She demonstrates how the authors of several Italian thesauri published in the nineteenth century tried to strengthen the linguistic unification of the country by using practical and logical grouping in their dictionaries rather than "an alphabetically arranged dialect-Tuscan homogloss dictionary in every Italian town" (172). The idea of a parallel

between Italian and Greek and between Florence and Athens was in the center of the argument.

Finally, Zorc discusses Philippine lexicography in the context of Philippine regionalism and nationalism. He writes that in many cases "native lexicographers refused to include widely-used Tagalog words in their studies because of a puristic attitude that developed via the polarization of local versus national language issues" (199). Zorc proposes instead that the nationalizing of Tagalog cannot be ignored by lexicographers.

Thus, ideology is one of the cultural issues that have been discussed in connection with dictionaries. The next issue that has received some attention in lexicographical literature is pluricentricity of languages and cultures in dictionaries. Algeo discusses British and American biases in English dictionaries, paying specific attention to examples of biases in the statement of usage limitations, choice of entries and senses, terms of definition, pronunciations, spelling priorities, grammatical categorization, and collocational restrictions. According to Algeo, "such bias is to be expected since the dictionaries of each nation are designed to serve the interests of that nation" (205).

Whitcut expresses a similar idea in her study of cultural preconceptions in English dictionaries. She points out that "although it purports to describe a world language, any dictionary of English must in practice deal chiefly with the English of its own place of origin" (253) and warns that "to take for granted that our own culture is universal is cultural myopia" (257). In her study, Whitcut analyses inclusion, definitions, examples, and illustrations in thirteen dictionaries of English.

Another study of pluricentricity of languages in dictionaries was conducted by

Kim, who considers dictionaries of Korean, which is a pluricentric language with "two cultural and linguistic centers, one in Seoul, South Korea, and the other in Pyongyang, North Korea" (213). Kim compares dictionaries published in South and North Korea focusing on authorship, lexical entries, and definitions and concludes that "with a state-controlled policy of self-reliance and socialization of language, the northern dictionaries contain more native entries, whose definitions are often prescriptive, while the southern counterparts contain an olio of entries and definitions that reflect a more open society with a more permissive language policy" (221).

As can be seen above, several issues connected with the cultural work done by dictionaries have been discussed in current literature. These issues include knowledge legitimation, creation of imagined communities, prescriptivism vs. descriptivism of dictionaries, ideology in dictionaries, and pluricentricity of language and culture in dictionaries. However, these studies only considered *general dictionaries*, that is, dictionaries that attempted to describe the whole language.

I will now discuss the main issues that have been studied in connection with dictionaries of science. In current literature, dictionaries of science are often grouped together with dictionaries of technology, and, as a result, the term *dictionaries of science and technology* is used in many sources. I will use the same term in this literature review.

While *general dictionaries* have been studied extensively, there is less literature on *specialized dictionaries* or dictionaries that describe only a certain part of a language (for example, dictionaries of finance, dictionaries of science and technology, dictionaries of slang, dictionaries of archaic words), and even fewer studies have been

conducted on *dictionaries of science and technology* that are a subtype of specialized dictionaries and may be further subdivided into dictionaries of medicine, chemistry, computing, engineering, etc. Hence, even though dictionaries of science and technology are important artifacts of scientific and technical communication, they have not been popular objects of study and their role in the scientific knowledge economy has been studied even less.

There are several common threads in the studies of dictionaries of science and technology that have been conducted. First, standardization has been a popular issue when it comes to dictionaries of science and technology. For example, Opitz calls standardization "the corner stone of technical lexicography" (166) and points out that it "works well beyond [the] range of natural respect paid to the printed page. It extends to the methods proper by which language elements are denoted" (166). Overall, standardization is seen by many researchers to be a necessary attribute of dictionaries of science and technology on several levels: the macro-level (the structure of the dictionary) (Cubillo 216) and on the micro-level (the structure of the dictionary articles including the definitions, of course) (Cubillo 216; Faber et al. 45; Frawley, *New Forms* 193; Pedersen 61). From the point of view of cultural studies, standardization is one of the types of cultural work dictionaries of science and technology do.

The second issue that has been discussed in the studies of dictionaries of science and technology is the cooperation of specialists in the subject field described by the dictionary and lexicographers (dictionary-makers), namely, the level of involvement of the former group in the creation of a dictionary. Very often "specialized dictionaries are thought to be outside the province of lexicographers" (Frawley, *New Forms* 194), so

that it is specialists in the subject fields (biologists, astrophysicists) who should create dictionaries in their fields. Lexicographers usually are not very familiar with the subject field the dictionary will describe. However, according to the sources I have analyzed, lexicographers should be the key figures in any project involving the creation of dictionaries of science and technology, and experts in respective subject fields should be used as one of the sources of information (Frawley, *New Forms* 196; Opitz 167; Pedersen 68-69). From the cultural studies perspective, the cooperation of lexicographers and specialists in the subject fields described by the dictionary is an issue connected with the role of institutions in dictionary-making.

Usability in dictionaries of science and technology has been considered by several researchers. For example, Opitz discusses the role of dictionary format in "making any technical dictionary a success with its public" (176) and focuses on the layout, the choice of a type, and the organization (175-176). Also, DeVries et al. emphasize the importance of usability in dictionaries of medicine and connect usability with standardization: it becomes easier for the reader to notice when information is absent if the standard format for the presentation of information is used (147).

Finally, several sources include a concise history of dictionaries of science and technology. While Opitz gives an extremely brief "historical outline" of *technical dictionaries* (164-166), Hoare provides a more comprehensive account of the history of dictionaries of science and technology focusing on Harris's *Lexicon Technicum* as the first representative of this genre and considering the history of the following groups of dictionaries separately: dictionaries of architecture and engineering, agriculture and husbandry, astronomy, botany and herbalism, chemistry, geology and mineralogy,

geography, mathematics, medicine, and zoology. Additionally, two analyzed sources focus on dictionaries of science published in the eighteenth century, namely, Yeo discusses *Dictionaries of Arts and Sciences* of the eighteenth century as a genre that appeared in a certain historical and cultural context, and Layton emphasizes the role of these dictionaries in the diffusion of scientific knowledge in Great Britain (226-234).

As can be seen from the discussion above, the main issues that have been studied in connection with dictionaries of science and technology are standardization, cooperation of lexicographers and the specialists in the subject fields described by the dictionary, usability, and the history of dictionaries of science and technology. However, very few studies (Yeo; Layton) provide a discussion of the role of the early dictionaries of science in the scientific knowledge economy, and none of the studies discusses modern dictionaries of science from this perspective.

Some types of cultural work that dictionaries perform have been considered in modern literature, but mostly in connection with general dictionaries. There are few studies that focus on dictionaries of science and technology as a genre; even fewer studies discuss that the cultural work of such dictionaries; and no literature was found that examines the cultural work of modern dictionaries of science and technology. This study will undertake that task, considering dictionaries of science and technology from the point of view of cultural work that they perform. In particular, I will consider how the first dictionary of science and one of the modern dictionaries of science participate in the scientific knowledge economy.

Chapter 3: Methodology and Theoretical Framework

3.1. Methodology

My methodology for this project is a combination of a cultural study with a lexicographical study. I consider dictionaries of science as participants in the scientific knowledge economy in a certain cultural context, and a cultural study is a logical choice for that. At the same time, this project is a lexicographical study because of the artifacts analyzed (dictionaries) and the types of information sought (the difference between several editions of the same dictionary).

Dictionaries are promising objects for cultural studies because they are an influential part of our culture. One of the reasons Longo gives to advocate the application of the cultural studies approach to technical writing is the connection of the latter with culture. She writes, "During the course of the twentieth century, our concepts of technical writing have developed in tandem with other elements of our culture. Like any other aspect of our culture, therefore, technical writing can be fruitfully explored through a cultural studies research network" (*Approach* 112). The same can be said about dictionaries in particular. Indeed, as books and artifacts of scientific and technical communication, they almost automatically become cultural artifacts.

Another reason why dictionaries are promising objects for cultural studies is the fact that dictionaries legitimize certain types of knowledge. In her discussion of the application of the cultural studies approach to technical writing, Longo emphasizes that technical writing "is the mechanism that controls scientific systems, thereby organizing the operations of modern institutions and the people within them. […] It can also be seen as a mundane discourse practice working to legitimate some types of knowledge

while marginalizing other possible knowledges" (*Approach* 111). According to Longo, the cultural studies approach allows the researcher to explore how technical writing "is involved within situated institutional relationships of knowledge and power – how some types of knowledge are legitimated through technical writing practice, while other possible knowledges […] are subjugated or excluded as marginal" (*Approach* 112). Dictionaries are interesting objects for cultural studies because they legitimize certain types of knowledge, and the cultural studies approach allows to address this.

3.2. Theoretical Framework

It is rather common to view dictionaries as lists of words with explanations of their meaning. However, dictionaries of science can also be understood as participants in the scientific knowledge economy, namely, as participants in knowledge making and as products of capitalism.

Dictionaries of Science as Participants in Knowledge Making

In order to consider dictionaries of science as participants in knowledge making, I used the following concepts: Longo's work connecting scientific and technical communication and the scientific knowledge economy, Latour's model of knowledge accumulation, Foucault's notion of additivity, and Leitch's notion of institutions.

One of the ideas that was used in the study is the connection between scientific and technical communication and the scientific knowledge economy. This connection has been established by Longo, who considers the relations between technical writing, technical knowledge, and economic security. On the one hand,

> Technical writing controls how technical knowledge is made. It allows for control of technical knowledge and its power within a society. It works to

> bring native or uneducated practices into the realm of theory and science. It is a mundane discourse practice working to enable some types of knowledge and practice, while disabling other possible knowledges and practices. Technical writing works to (de)stabilize knowledge and practice within institutional and societal systems. It is shaped by these systems, while simultaneously shaping them. (*Spurious Coin* x)

On the other hand,

> [The] notions of scientific knowledge, technical writing, and economic security run deep under current technical writing practices, forming a foundational metaphor for assigning value to knowledge through technical writing. […] The stamp of science gave technical language its economic value, just as the stamp of the King gave coinage its representational value as currency. (Longo, *Spurious Coin* xiii)

Therefore, scientific and technical communication participates in the scientific knowledge economy. It makes sense to use this idea for the study of dictionaries of science because, as artifacts of scientific and technical communication, such dictionaries participate in the scientific knowledge economy.

Second, I used Latour's model of knowledge accumulation. According to Latour,

> What is called 'knowledge' cannot be defined without understanding what *gaining* knowledge means. In other words, 'knowledge' is not something that could be described by itself or by opposition to 'ignorance' or to 'belief,' but only by considering a whole cycle of accumulation: how to bring things back to a place for someone to see it for the first time so that

> others might be sent again to bring other things back. How to be familiar with things, people and events, which are *distant*. (220)

Latour introduces the following model of knowledge accumulation:

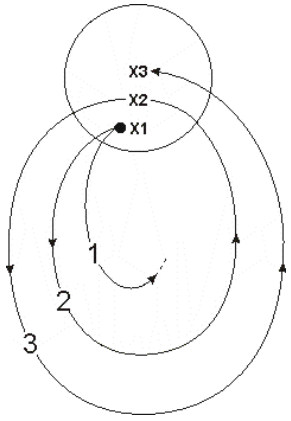


Figure 1. Latour's Model of Knowledge Accumulation (220-221).

Latour explains his model in the following passage:

> Expedition number one disappears without trace, so there is no difference in 'knowledge' between the first and the second that fumbles its way in darkness always at the mercy of each of the people whose path is crossed. More fortunate than the first, this second expedition not only comes back but brings something (noted X2 in the drawing) that allows the third to be so familiar with the coastline that they can quickly move to other lands bringing home parts of a map of a *new* territory (X3). At every run of this accumulation cycle, more elements are gathered in the center (represented by a circle at the top); at every run the asymmetry (at the bottom) between the foreigners and the natives grows. (220-221)

Latour uses two key concepts: 1) exploring new territory and 2) creating maps as his examples of gaining knowledge. However, his model can be applied to compiling

new dictionary editions. If the material for the first dictionary edition has been collected, but that dictionary edition does not get published, "there is no difference in 'knowledge' between the first and the second" editions (Latour 220). Further, the dictionary compiler collects the material for the second dictionary edition and publishes it (X2 in the drawing), which allows the compiler of the third dictionary edition to be familiar with the published material and to "bring home" and add new information (X3). Creating every dictionary edition becomes the "run of this accumulation cycle" (Latour 221), so in every dictionary edition, "more elements are gathered in the center" (Latour 221).

Dictionary editions, or X1, X2, X3, etc., are what Latour calls *immutable and combinable mobiles*. In his model of knowledge accumulation, in order to "bring home" "unfamiliar events, places, and people" (223), it is necessary to invent means that:

> a) Render them [unfamiliar events, places, and people] *mobile* so that they can be brought back;
>
> b) Keep them [unfamiliar events, places, and people] *stable* so that they can be moved back and forth without additional distortion, corruption or decay, and
>
> c) Are *combinable* so that whatever stuff they are made of, they can be cumulated, aggregated, or shuffled like a pack of cards. (223)

Dictionaries render the new information mobile, keep it stable, and are combinable, therefore, they can be the means that help "bring home" the unfamiliar.

Latour's model of knowledge accumulation is a promising model for this study because it allows me to examine how dictionaries participate in knowledge making.

Latour's model illustrates the accumulative nature of knowledge as it describes a whole cycle of knowledge accumulation that helps “bring things back to a place for someone to see it for the first time so that others might be sent again to bring other things back” and “to be familiar with things, people, and events, which are distant” (220). Similarly, when a new edition of a dictionary is created, some new information is gathered at a distance and then brought to the center so that dictionary users may “see it for the first time” (Latour 220) and a group of lexicographers might begin a new cycle of knowledge accumulation in order to bring new information to the center and create a new dictionary edition. Latour's model gives a firm basis for the description of how knowledge is created with the help of dictionaries.

Foucault’s notion of *additivity* appears to be if not completely synonymous then at least somehow similar to Latour’s *knowledge accumulation*. Foucault focuses on the specificity of the forms of additivity in different cases:

> This analysis also presupposes that statements are treated in the form of *additivity* that is specific to them. In fact, the types of grouping between successive statements are not always the same, and they never proceed by a simple piling-up or juxtaposition of successive elements. Mathematical statements are not added to one another in the same way as religious texts or laws (they each have their own way of merging together, annulling one another, excluding one another, complementing one another, forming groups that are in varying degrees indissociable and endowed with unique properties). Moreover, these forms of additivity are not given once and for all, and for a particular category of

> statements: medical case-history today forms a corpus of knowledge that does not obey the same laws of composition as medical case-history in the eighteenth century; modern mathematics does not accumulate its statements according to the same model as Euclidean geometry. (124)

From this point of view, dictionary versions accumulate a corpus according to specific rules that might be characteristic of dictionaries, but that might not work for other types of discourse.

Another notion that is used in this study is the notion of institutions. According to Leitch,

> Through various discursive and technical means, institutions constitute and disseminate systems of rules, conventions, and practices that condition the creation, circulation, and use of resources, information, knowledge, and belief. Institutions include, therefore, both material forms and mechanisms of production, distribution, and consumption and ideological norms and protocols shaping the reception, comprehension, and application of discourse. On the material level of the institution of, for example, university literary studies, one would situate such apparatuses as academic publishing companies, bookstores and libraries, while on the ideological level one would add canonical literary history, classroom pedagogy, and normative critical practice. (128)

In a study that focused on dictionaries of science as participants in knowledge making, it appears to be important to consider the role of such institutions as publishing companies in this process.

Institutions are also part of Latour's model of knowledge accumulation. Latour points out that "if […] conditions [for immutable and combinable mobiles] are met, then a small provincial town, or an obscure laboratory, or a puny little company in a garage, that were at first as weak as any other place will become centers dominating at a distance many other places" (223). In the model, these centers are represented by the smaller circle at the top of the accumulation cycles (see Figure 1).

Longo's idea about the connection between scientific and technical communication and the scientific knowledge economy, Latour's model of knowledge accumulation, Foucault's notion of additivity, and Leitch's notion of institutions are helpful for the analysis of dictionaries of science as participants in the scientific knowledge economy.

Dictionaries of Science as Products of Capitalism

In addition to being participants in the knowledge-making process, dictionaries in general and dictionaries of science in particular are products of capitalism.

As Anderson points out, books became one of the most important products of capitalism with the invention of print: "One of the earlier forms of capitalist enterprise, book-publishing felt all of capitalism's restless search for markets" (38). Anderson further emphasizes the role of booksellers in this process: "Booksellers were primarily concerned to make a profit and to sell their products, and consequently they sought out first and foremost those works which were of interest to the largest possible number of their contemporaries" (38). However, dictionaries can be called "quintessential books." Probably the best explanation of this point is given by Kernan with reference to one of the major English dictionaries, Johnson's *A Dictionary of the English Language*: "The

Dictionary was a typical achievement of print, a language book made out of still other books that would determine the language of books still to be written" (197). Kernan elaborates on this definition and points out that the *Dictionary*'s sources were printed books including earlier dictionaries (184), so it is possible to talk about an even higher degree of dependence on print: if a dictionary is a book based on other books, then a dictionary based on other dictionaries is a book based on other books that are based on other books. Because printed books are one of the earliest capitalist products and dictionaries are quintessential books, it becomes obvious that printed dictionaries are typical products of capitalism.

Contemporary lexicographers agree that dictionaries are made to be sold. For example, Landau states that "dictionary making is nothing less than the attempt to fashion a custom-made product on an assembly-line basis" (343). He uses the following analogies to clarify this point: "The architect commissioned to design a building must know, first of all, to what uses the building will be put. A hospital requires an altogether different design from that of an office building or a church. Just so, the lexicographer is commissioned by a publisher to design a dictionary for a particular purpose or, as we should say, for a particular market" (343).

Because dictionaries are products of capitalism and are made to be sold, I am proposing to expand Latour's model of knowledge accumulation by adding consumption cycles to the knowledge accumulation or production cycles (see Figure 2).

Figure 2 can be explained in the following way. Production cycle 1 is incomplete if the material for the first dictionary version has been collected, but that dictionary version does not get published. After the dictionary compiler collects the

material for a dictionary version and publishes it (X2 in the drawing; production cycle 2 is completed), this dictionary version is sold and used by the public (consumption cycle

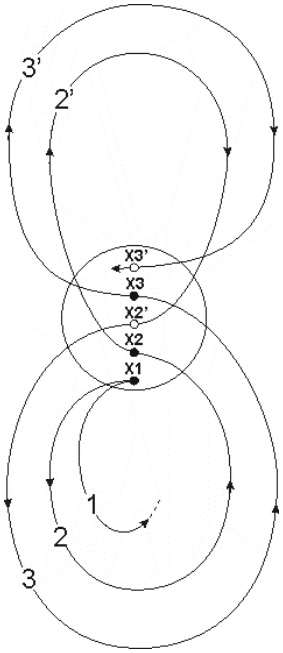


Figure 2. The Model of Production-Consumption Cycles.

2' is completed). Going through the consumption cycle might provide some additional information that potentially could lead to a new dictionary version (X2'). However, at this point, this dictionary version is not realized. After that, production cycle 3 begins: the compiler of the third dictionary version "brings home" and adds new information to the second dictionary version, which leads to the third version (X3), so production cycle 3 is completed. The third version is then sold and used by the public (consumption cycle 3'), etc. Creating every dictionary version becomes the production cycle, and selling and using this version – the consumption cycle.

The production-consumption cycles could be helpful for the analysis of dictionaries of science as participants in the scientific knowledge economy because this

model provides a more complete picture of how such dictionaries function than Latour's model of knowledge accumulation.

Chapter 4: Methods

4.1. Dictionary Selection

Reference works for the analysis were selected according to a certain set of criteria. The study focuses on dictionaries of science, therefore, the first criterion for selection was the presence of the words "dictionary" and "science" or "scientific" in the title. Second, all of the dictionaries are multifield, that is they "cover […] several subject fields" (Bergenholtz and Tarp 58). Third, because the study compares one of the oldest dictionaries of science published in English with one of the most recent dictionaries of science published in the same language, one of the analyzed dictionaries needed to have been published in the eighteenth century, when the first dictionaries of science appeared in English, and the second dictionary needed to be as recent as possible. Similarly, the eighteenth century dictionary needed to have been published in Great Britain because that was the place of origin of such dictionaries. The modern dictionary needed to have been published in a country where English is one of the official languages (the US, for example) so it would be possible to compare this dictionary with the old one. The next selection criterion was the number of dictionary editions. According to Hartmann and James, *an edition* is "the particular version of a document such as a book or dictionary at the date of its publication. Depending on the frequency of its reissue and the nature of the changes made to the original text, it may be an identical 'impression' (reprint) or a substantially revised ('new' or 'second,' 'third' etc.) or abridged edition" (47). All selected dictionaries have gone through at

least two editions. This criterion was chosen because going through several editions demonstrated that the dictionary was successful on the market.

Initially, the following dictionaries were selected for the analysis because they satisfied all the criteria listed above:

- Harris, John. *Lexicon Technicum: or, An Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* 1704, 1708, 1710, 1716, 1723, 1725, 1736.
- Society of Gentlemen. *A Supplement to Dr. Harris's Dictionary of Arts and Sciences.* 1744.
- Barrow, John. *A New and Universal Dictionary of Arts and Sciences.* 1751, 1764.
- Barrow, John. *A Supplement to the New and Universal Dictionary of Arts and Sciences.* 1754.
- *McGraw-Hill Dictionary of Scientific and Technical Terms.* 1974, 1978, 1984, 1989, 1994, 2003.
- *American Heritage Science Dictionary*. 1986, 2008.
- *American Heritage Student Science Dictionary*. 2002, 2009.
- *American Heritage Children's Science Dictionary*. 2003, 2010.
- *Academic Press Dictionary of Science and Technology*. 1992, 1996.

From this list, I then chose one dictionary published in the eighteenth century and one dictionary that appeared in the twentieth century. Because commercially successful dictionaries provide more data for discussing dictionaries as products of capitalism, the

dictionaries with the largest number of editions were selected. The final list included the following dictionaries:

- Harris, John. *Lexicon Technicum: or, An Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* 1704, 1708, 1710, 1716, 1723, 1725, 1736.
- Society of Gentlemen. *A Supplement to Dr. Harris's Dictionary of Arts and Sciences.* 1744.
- *McGraw-Hill Dictionary of Scientific and Technical Terms.* 1974, 1978, 1984, 1989, 1994, 2003.

4.2. Data Collection and Analysis Method

The first method was *cultural analysis*. First, I analyzed the front matter of the first edition of each dictionary by looking for themes and placing them in the cultural and historical context using additional material. Next, I compared the front matter of the first edition of the dictionary with the front matter of the second edition, then the front matter of the second edition with the front matter of the third edition, and so on, looking for differences. I then placed the new themes in cultural and historical context.

The second method was *lexicographic archaeology*. According to Ilson,

> Lexicographic Archaeology (calqued on 'Industrial Archaeology') is one if the component disciplines of lexicography. It consists in the comparison of different editions of the same dictionary, of different dictionaries derived from a common source, or different dictionaries from the same publisher. It is an especially manageable instance of the more general enterprise of comparing dictionaries critically.

> Lexicographic Archaeology can reveal facts about the language itself, can cast light on important problems of dictionary-making, and can play an important role in the training of lexicographers and dictionary reviewers. (127)

Lexicographic archaeology allowed me to compare different editions of the same dictionary in both cases. I copied every 20th page of the word list of the first edition of a dictionary for the analysis. Using every 20th page allowed me to analyze 5% of each dictionary. Because dictionaries tend to be rather voluminous and, therefore, difficult to analyze, this percentage was recommended for lexicographical studies by Karpova in her "Introduction to Lexicography" course, which is part of one of the leading lexicographical programs in Europe. I marked the first entry word on each page "entry A" and the last entry word on the page "entry B," found "entry A" and "entry B" in the second edition of the same dictionary, and compared the text starting from "entry A" and ending with "entry B" in the first edition of the dictionary with the corresponding text in the second edition of the dictionary. When "entry A" was not found in the later edition, the next term that was present both in the earlier and later editions was used. When "entry B" was not found in the later edition, the previous term that was common for both editions was used. Only the pages with at least one complete article were used. I then recorded the differences that I found and classified them according to the categories that were created during the analysis.

The third method was employing *production-consumption model*. This method allowed me to examine how each dictionary edition functions in the production-consumption cycles (see Figure 2). Because I used the results of the cultural analysis

and the results of the lexicographic archaeological analysis for this part of my study, the results of using production-consumption model were essentially the discussion of the data and, therefore, formed Chapter 7: Discussion.

Chapter 5: *Lexicon Technicum*

5.1. Cultural Analysis of the Front Matters of All Editions

Edition 1: Volume I (A-Z), 1704

In the front matter of the first edition of Volume I, *Lexicon Technicum*, the dictionary compiler tries to legitimize the information presented in the book. First, the data about the author is used for that purpose. The dictionary was written by John Harris, and both the frontispiece and the title page state that he was Master of Arts. Therefore, Harris's academic degree helped establish authority. John Harris won a scholarship to Trinity College, Oxford (Green 205) and graduated B.A. in 1686 and M.A. at Hart Hall in 1689 ("Harris, John").

Harris also used his affiliation with the Royal Society to establish authority: both the frontispiece and the title page state that he was Fellow of the Royal Society. Harris had been elected a fellow of the Royal Society in 1696 and published a paper on "microscopical observations of animalcula" in *Philosophical Transactions* ("Harris, John"). In 1698 he was also chosen to deliver so called "Boyle lectures" – "a series of sermons in memory of Robert Boyle and in proof of the Christian religion against infidelity" (McKie 53). Moreover, he lectured on mathematics at his home and in the Marine Coffee house in Birchin Lane, London (McKie 53; "Harris, John").

As Sprat points out in his *History of the Royal Society of London,* which was first published in 1667, the Society was "very numerous" (71) because of "the Age wherein

we live" (71). Sprat further explains such popularity of the Society: "For now the genius of *Experimenting* is ſo much diſpers'd that even in this *Nation*, if there were one, or two more ſuch *Aſſemblies* ſettled; there could not be wanting able men enough, to carry them on" (71). By the time the first edition of the dictionary was published, the Royal Society was popular, which may explain Harris's choice to use its name in order to legitmize the information found in the dictionary.

Also, the languages used on the frontispiece and the title page helped both legitimize the information presented in the dictionary and to appeal to a larger audience. Latin was used on the frontispiece as a learned, more prestigeous language. The frontispiece was the first page a user would see, so using Latin could be interpreted as an attempt to establish the status of the dictionary right away. On the other hand, English was used on the title page even for the information that was in Latin on the frontispiece, which would help to reach wider audiences.

Furthermore, the King's name helped legitimize the information presented in the dictionary. The front matter of the dictionary contains a dedication "to His Royal Highneſs' because of the King's "Patronage of this Work." Harris begins the dedication the following way,

> Great Sir,
>
> I Juſtly eſteem it a Peculiar Happineſs to me, that You were pleas'd to Accept of the Patronage if this Work: For hereby You exempt me from that hardſhip which attends moſt Dedicators, of Inventing the Vertues they Celebrate.
>
> But tho' Your Intrinſick Excellence and Real Worth takes away all

> Poſſibility of Flttery, yet being convinces that whatever I can ſay, falls ſhort of Your Merit: I Bluſh as much at my Incapacity of giving You Your juſt Due, as I ſhould at aſcribing more than be deſerved, to another.

At the time of publication of the first edition of *Lexicon Technicum*, George, Prince of Denmark, was the consort of Queen Anne. He married Princess Anne in 1683 and after Anne's accession in 1702 was appointed generalissimo and then lord high admiral. The year the first edition of the dictionary was published, he became a fellow of the Royal Society, so there might be a connection between these two events. He was mostly interested in navigation and seafaring, but also helped publish the *Observations* written by the royal astronomer, John Flamsteed ("George, Prince"). Hence, it is possible that he was interested in *Lexicon Technicum* as well.

However, as Yeo points out, publication by subscription, which became common at that time and which was used for *Lexicon Technicum* as I will discuss below, made offering a book to a patron or a person of high office unnecessary (224). Yeo writes that before that, the dedication of books was a way for the authors to seek assistance from wealthy patrons (223). Even though Harris used publication by subscription for his dictionary, he still chose to dedicate the book to the King, which helped him legitimize the information found in *Lexicon Technicum*.

Another name that Harris used to establish authority of his dictionary was Isaac Newton's. There were numerous references to Newton in the Preface. For example, Harris discusses the "admirable Helps to the Underſtanding of Nature, which *Geometry* applied to *Physical Enquiries*, hath of late afforded us, and to which indeed we are chiefly indebted to that Prodigious Mathematician Mr. *Iſaac Newton*." He also

apologizes for not having used Newton's ideas more: "I'm ſorry I had time to take no more from Mr. *Newton*'s Excellent Book of *Opticks* lately published; but what I could, I have inſerted." In addition to being famous throughout the learned world, Newton was "the greatest name" in the history of the Royal Society (Andrade 6). He was elected a fellow in 1671 and became President of the Royal Society in 1703, only a year before the first edition of the dictionary was published, and held this office until his death in 1727. According to Andrade, Newton's "fame no doubt contributed substantially to that of the Royal Society, which under him rose rapidly in numbers and in reputation" (7).

The Preface also contains many references to how comprehensive the dictionary is. Harris mentions the following subject fields represented in the dictionary: Geometry, Algebra, Aſtronomy, Gunnery, Fortification, Civil Architecture, Navigation, Laws of Motion, "Mechanicks, Nature, and Properties of Staticks," Hydrostaticks, Phyſics and Natural Philosophy, Botany, Chymiſtry, Anatomy, Heraldry, and Law. Harris provides detailed descriptions of how each field is treated in the dictionary. For example, here is his explanation of how Geometry is represented:

> In *Geometry*, under the name of each Figure, you have the eſſential Properties of it briefly and plainly demonſtrated; and the Application of it to practice ſhewed: So that by the help of very eaſie References from one place to another, you will find the Demonſtration of all ſuch uſeful and important Propoſitions, in the Noble Science, as are uſually given by *Geometrick* Writers.
>
> Under ſuch Words as *Parabola*, *Ellipſis*, *Hyperbola*; alſo in the *Conick Sections* you will find the Properties of each Figure or *Section* demonſtrated,

> with Methods for their Deſcription on a Plain; as alſo the Properties of the *Cycloid, Conchoid, Logarithmick-Line, Ciffoid, Quadratrix* and *Spiral-Lines*, & c. Some general Conſiderations of the Nature of *Aſymptotes*, the Nature and Properties of *Catacauſtick* and *Diacauſtick* Figures, of the *Involute* and *Evolute* of the *Linea Celerrimi Deſcenſus*, & c. And under the Word *Conſtruction*, you have the Conſtruction of *Cubick* and *Biquadratick Equations* by the *Parabola*; together with the Inveſtigation of *Baker's Central Rule*, and its Uſe and Application.
>
> Under ſuch general Words as *Trigonometry*, *Surveying*, *Spherical-Geometry*, *Projection*, & c. you will find Entire Treatiſes on theſe Heads; and which, if I miſtake not, are as ſhort and plain, as any yet extant.

Such detailed description of the content of the dictionary can be seen as an attempt to demonstrate that the dictionary describes "everything" and, therefore, creates a "complete" corpus of knowledge.

There is a close connection between creating a "complete" corpus of knowledge and the cultural context. According to Foucault, *order* became one of the key notions of Western culture in the seventeenth century. As Foucault writes, "[the] relation to *Order* is as essential to the Classical age as the relation to *Interpretation* was to the Renaissance. […] The ordering of things by means of signs constitutes all empirical forms of knowledge as knowledge based upon identity and difference" (57). Now, "all knowledge is obtained by the comparison of two or more things with each other" (Foucault 52). Therefore, the table becomes the center of knowledge in the seventeenth and the eighteenth centuries (Foucault 75). One example of creating a "complete"

corpus of knowledge and ordering it is the work of Linnaeus who "conceived the project of discovering in all the concrete domains of mature or society the same distributions and the same order" (Foucault 76). Hence, Harris's attempt to describe "everything" can also be interpreted as an attempt to create such a corpus and order it.

The front matter of the first edition of Volume I of the dictionary also provides some information about the people involved in creating and selling the dictionary. John Harris is, of course, identified as the author. In addition, the title page contains the imprint, or what Feather calls "a sort of book-trade code" (60), about other figures involved in the publication and distributing of the dictionary: "LONDON, Printed for *Dan. Brown, Tim. Goodwin, John Walthoe, Tho. Newborough, John Nichol/on, Tho. Benskin, Benj. Tooke, Dan. Midwinter, Tho. Leigh,* and *Francis Coggan,* MDCCIV." According to Feather, "Printed for" signals that the copyright owner was his own distributor (60). The imprint on the title page signals that the first edition of Volume I of the dictionary was printed in London in 1704, and the people enumerated owned the copyright and distributed the dictionary.

The front matter also contained a list of dictionary subscribers titled "A Catalogue of the Names Of as many of the SUBSCRIBERS to Lexicon Technicum, As came to our Hands." This shows that *Lexicon Technicum* was a product of publication by subscription, common in England at the beginning of the eighteenth century. Feather describes the system of publication by subscription the following way:

> The system is a simple one: the author announces his intention to write and publish his book, and the publisher undertakes to provide copies to certain specifications of type and paper at a specified time, in return for advance

> payment by the purchaser, who, as a reward, had not only the book, but also, in many cases, the pleasure of seeing his name in the printed list of subscribers whose interest and money had made publication possible. In short, publication by subscription is a form of patronage in which the individual patron of earlier centuries is replaced by a group of people, many of them unknown to the author or to each other, who wish to see the book published. (1)

In the case of *Lexicon Technicum*, in order to advertise the first edition of Volume I to potential subscribers, Harris published *Proposals* in 1702. In this document, in addition to describing the dictionary, Harris pointed out the benefits of subscribing, "The Expence in this Work being very great, and the Deſign univerſally uſeful, we hope it will meet with proportionable Encouragement; and thoſe Perſons that Subſcribe ſhall have their Name, Title, Seat, & c. printed before the Work, as Encouragers thereof" (2).

Apparently, Harris's announcement was successful: there were 906 names on the list of subscribers in the first edition of Volume I of *Lexicon Technicum*. According to this list, the subscribers came from a number of professions, connected with law, religion, science, trade, bookselling and bookprinting. The titles ranged from "Esq.," "Mr.," "Madam," and "Mrs." to "His High Excellence," "His Grace," and "The Right Honorable." There was a market for a dictionary of science, and Harris's *Proposals* reached a very wide audience.

At the end of the Preface, Harris criticizes his own dictionary, promising to correct the faults in Volume II. He specifically focuses on the lack of some information, which he intended to include initially. In two cases, he blames others for this:

I ſhall next fairly acquaint you wherein it is defective, and what Improvements may be made of it hereafter, in an additional Volume.

The Catalogue, Right-Aſcenſions, Declinations, & c. of the *Fixed-Stars*, is very imperfect; the Reaſon of which is, That Mr. *Flamſtede*, upon whom I thought I might depend, was pleaſed to refuſe me any Communication of that kind; elſe I would have given thoſe things under the Name of each Star or Conſtellation.

There are alſo, I doubt, here and there ſome Words which my *Amanuenſis* or *Aſſiſtant* tranſcribed from other Dictionaries, which are not ſo well explained as they ſhould be, and which (among ſo many Thouſand Words as I had to range into Order) have eſcaped a Review; but I have corrected as many of them as I could in each Sheet as the Book was Printing off.

I would have had alſo at the End of the Book, a particular *Alphabet* for each *Art* and *Science* by it ſelf; and ſome more and larger Copper-Plates in *Anatomy*, and of the *Outſide*, *Rigging*, and the *Section* of a *Ship*. But the Undertakers could not afford it at the Price propoſed, the Book having ſwelled ſo very much beyond the Expectation: But whatever Alterations, Amendments, Improvements and Additions ſhall be hereafter, as I queſtion not but many of the latter ſort Time will produce, if God pleaſe to Bleſs me with Health and Leiſure, theſe ſhall all be Printed in a Volume by themſelves, and ſo by no means be prejudicial to the firſt Imperſſion.

Such criticism of the current volume allows Harris to present the next volume of the

same reference work to the same audience, thus, leading to another book in the series of *Lexicon Technicum*.

Edition 2: Volume I (A-Z), 1708

However, chronologically, the next edition that was published again contained only Volume I. The information about the author provided in the frontispiece and on the title page was updated. It is stated that John Harris is Doctor of Divinity now (he was given the degree in 1706 ("Harris, John")). The academic degree is higher than the one stated in the previous edition and, therefore, can be effective in legitimizing the information presented in the dictionary. A similar case is found in the Preface: when discussing the sources of the *Laws of Motion*, Harris uses "Mr." before "*Iſaac Newton*" in the first edition, but "Sir" in the second edition.

Three people (Tho. Benskin, Benj. Tooke, and Tho. Leigh) (see Table 1) disappeared from the imprint, so the number of people who owned the copyright and distributed the dictionary became smaller. Harris was still stated as the author of the dictionary.

The rest of the front matter was very similar to that of the first edition of Volume I. In several cases, punctuation and capitalization were changed, but no other significant differences in the text were found.

Edition 1: Volume II (A-Z), 1710

Finally, after two editions of Volume I, the first edition of Volume II was published in 1710. The volume contained a new front matter. The information about the author of the dictionary was updated and again used to legitimize the dictionary. In addition to being Doctor of Divinity, John Harris is also identified as "Secretary to the

Royal-Society, and Chaplain to the *Lord High-Chancellor* of Great Britain." He served as Secretary to the Royal Society only briefly, from 1709 to 1710 ("Harris, John"), and became chaplain to William Cowper, the Lord High Chancellor of Great Britain sometime between 1706 and 1708 ("Harris, John").

Just as in Volume I, a Dedication helped legitimize the information presented in the dictionary. Harris wrote a new Dedication for Volume II. This time, it was not addressed to the King, but "to the Right Honorable William Lord Cowper, Baron of Wingham, and Lord High-Chancellor of Great-Britain." Harris's choice was obvious in this case: in addition to being Lord Cowper's chaplain, Harris obtained a prebendary in Rochester Cathedral and the united parishes of St. Mildred, Bread Street, and St. Margaret Moyses through Cowper's influence in 1708 ("Harris, John"). Still, Lord Cowper's name and title added authority to the dictionary.

In addition to praising Lord Cowper in the Dedication, John Harris mentions the success of Volume I and the patronage of the King: "The great Honour and Advantage which the former Volume of this Work receiv'd from the Patronage of His Royal Highneſs, the Late Prince George of Denmark, encourages me to Dedicate This to Your Lordſhip." In other words, Harris linked Volume II with Volume I to ensure the commercial success of the new volume.

Just as in Volume I, Harris uses Newton's name and work as well as different languages to legitimize the information found in Volume II and to appeal to different audiences. The Introduction is followed by Newton's essay *Some Thoughts about the Nature of Acids*, and Harris introduces it by saying that "the following Paper of Sir *Isaac Newton's* is excellently well worth the Philoſophical Reader's moſt ferious and

repeated Peruſal." Two variants of the essay are included; the first one (the original version written by Newton) is in Latin, which was the "learned" language that helped establish the status of the dictionary. The second version of the essay was in English, which made the text accessible to a wider audience. Harris apologizes for the difference between the English translation and the Latin original by stating that the translation was "taken from another Copy a little different from this Latin Paper." However, according to Harris, Newton verified and approved this translation, so Newton's name is again used to give the text more authority.

In the Introduction, Harris explains what was special about Volume II. First, he writes about the new information Volume II contains, "In this Second Volume, as I promiſed both in the *Preface* to the Firſt, and alſo in the *Propoſals* for This, the *Matter* is intirely *New*, and without any Repetition, that I know of, of any thing in the *Former*; and that ſhall be my Method, if ever I Publiſh any thing further in this Way." Therefore, according to Harris, Volume II adds a large amount of information to the corpus of knowledge constructed by Volume I.

The same idea is stated in the discussion of how mathematics is treated in Volume II. Harris writes,

> And becauſe I would have theſe Two Volumes to ſerve as a kind of ſmall Mathematical Library, and prevent in ſome meaſure the Neceſſity and Charge of buying many Books on theſe Subjects; I have alſo, as I deſign'd at firſt, given you in this Volume very good Tables of Logarithms, Sines, Tangents and Secants, with a full Account of the Nature, Uſe and Application of them; ſo that nothing will be wanting here to compleat

> Trigonometry, both Plain and Spherical; and the Practice of it in Navigation, Dialling and Aſtronomy, & c.

Here, Harris refers to the idea of a complete "library" or a complete corpus of knowledge to emphasize that Volume I and Volume II complement each other and contain all the information about mathematics there is. This should motivate the user to buy the two volumes of this particular dictionary, but keep him/her disinterested in other reference works.

The front matter of Volume II of the dictionary also provides some new information about the people involved in creating and selling the dictionary. John Harris is still stated as the author, but the imprint has changed: Mr. Newborough and Mr. Coggan were replaced by Mr. Atkins and Mr. Ward (see Table 1). However, all the people enumerated in the imprint still owned the copyright and distributed the dictionary.

Similar to the front matter of the first edition of Volume I, the first edition of Volume II contained a list of dictionary subscribers titled "A Catalogue of the Names Of as many of the Subscribers to Lexicon Technicum As came to our hands." The system of publication by subscription common in England in the eighteenth century was again at work here. In order to advertise the first edition of Volume II and the second edition of Volume I, Harris first published *The Proposals* in 1707. In this document, he again described the dictionary and pointed out the benefits of subscribing. This led to 1240 names on the list of subscribers.

The list for the first edition of Volume I and the list for the first edition of Volume II demonstrate that these books shared the market and that there was a growing interest

in *Lexicon Technicum*. The majority of subscribers (862 people) were on both lists. Also, 378 names were added to the second list, and only 44 disappeared. The list was again very diverse in terms of the social status of the subscribers who represented many different professions connected with law, religion, science, trade, bookselling and bookprinting. Just as in the first list, the titles ranged from "His High Excellence," "His Grace," and "The Right Honorable" to "Esq.," "Mr.," "Madam," and "Mrs." Hence, overall, the subscribers who owned the first edition of Volume I were interested in Volume II, and the dictionary had a good reputation.

Edition 3: Volume I (A-Z), 1716

The front matter of the third edition of Volume I was very similar to that of the first edition of Volume I. The only significant difference was found in the imprint: Mr. Atkins was no longer one of the people who had the copyright and distributed the dictionary (see Table 1). Punctuation, capitalization, and spelling were changed in several cases, but no other significant differences in the text were found.

Edition 2: Volume II (A-Z), 1723

The front matter of the second edition of Volume II has not been changed much when compared with the front matter of the first edition. On the title page, Harris's death is mentioned for the first time ("late Secretary to the *Royal Society*"). Also, the imprint is again altered: Mr. Knapton, Mr. S. Tooke, Mr. Cowse, and Mr. Symon were added to the list of people who had the copyright and distributed the dictionary while Mr. Goodwin and Mr. Nicholson were deleted from the list (see Table 1).

Edition 4: Volume I (A-Z), 1725

Again, the front matter of the fourth edition of Volume I is similar to that of the

previous edition of the same volume. The only significant difference was found in the list of people named in the imprint: Mr. Motte replaced Mr. B. Tooke (see Table 1). As in all previous editions of both volumes, all the people on the list had the copyright and distributed the dictionary.

Edition 5: Volume I (A-H) and Volume II (J-Z), 1736

In the fifth edition of the dictionary, the two volumes were combined in one alphabet, and then two new volumes were created: the first contained letters A through H, and the second – letters J through Z. Only the first volume had front matter, which demonstrates that the two volumes were finally meant to be bought and used together.

All of the decisions regarding the changes to the dictionary were made by a group of people who called themselves "the Editors." It is, however, unclear who exactly these people were, and Harris is still stated as the author of the dictionary. As in the previous editions, several changes were made to the list of people who had the copyright and distributed the dictionary: eight new names replaced Mr. Tooke, Mr. Cowse, and Mr. Valentine (see Table 1).

The title page stated directly what was special about this particular edition: "The fifth edition. Now digeſted into one Alphabet: With very conſiderable Additions and Improvements from later Diſcoveries in *Mathematicks* and *Philoſophy*, & c. Illuſtrated with ſeveral Additional Copper-Plates, and many new *Diagrams*." The publishers signal right away that the new edition of the dictionary will add to the existing corpus of knowledge. The same idea is then stated in the Preface: in order to make the dictionary appear even more complete, "the Editors" enumerated the types of additional information found in the fifth edition. These types included "Improvements made in the

Arts and Sciences," new "Technical Words and Terms of Art," etymologies, new tables, and copper plates.

"The Editors" connected the notion of "complete" knowledge with the notion of usability when explaining the change in the structure of the dictionary,

> Whereas the former Editions were in two diſtinct Alphabets, each Volume in one, ſo that many, if not moſt of the Articles of the Firſt Volume, ended incomplete, and required that the Second muſt alſo be conſulted for the additional Matter, which was no ſmall Inconvenience and Trouble to the Peruſer: In this Edition, the two Alphabets are brought into one, and thoſe Additions in the Second Volume are ſubjoined immediately after the Firſt; and ſo the Matter carried on in a continued Series.

If this logic is followed, the fifth edition of the dictionary is more usable because each article is "complete," so all available knowledge is stored in one place that is easily accessible.

The King's name was again used to legitimize the information found in the dictionary. In Volume I, "the Editors" decided to use the Dedication to the King, which was present in the previous editions of Volume I, not the Dedication to Lord Cowper from the earlier editions of Volume II. This could be explained by the higher social status of the King; his name gave more authority to the dictionary. Because Volume II did not have any front matter, the Dedication to Lord Cowper was not used at all.

A Supplement to Dr. Harris's Dictionary of Arts and Sciences: 1754

While the *Supplement* is not the next edition of *Lexicon Technicum*, it is still a reference book from the same series that adds on to the information contained in the

dictionary discussed above. According to the title page, the dictionary was compiled by "A Society of Gentlemen," so the authors remain anonymous. In the Preface, they emphasize the connection of their book with Harris's dictionaries by stating that their dictionary is "a Continuation of a Work ſo excellent in its kind as Dr. Harris's Dictionary." On the title page, the authors also state that this volume "will, together with Dr. Harris's two Volumes, make the moſt uſeful Set of Books." The authors enumerate the "subjects" treated in the dictionary and state that in all of them "this Book is of *itſelf* entirely compleat" and that together with Harris's dictionaries their book will make the moſt "compleat Body of Arts and Sciences yet extant." They further clarify the additional information contained in their dictionary, "Thoſe subjects in which Dr. Harris is any way deficient are here perfected; no trifling and inſignificant Words inserted, but only ſuch as may convey ſome uſeful and entertaining Knowledge to the Reader." The authors first of all use Harris's name and authority to promote their dictionary, and, secondly, try to add on to the corpus of knowledge formed by Harris.

In order to legitimize the information in the dictionary, the authors include a Dedication to the Prince of Wales. They point out his interest in the Sciences, "This near Concern the Sciences have in the Happineſs of a People, aſſures them of the gracious Attention of a Prince, with whom all generous Attempts to promote uſeful Knowledge, meet with a favourable Reception." In 1754, when the *Supplement* was published, George William Frederick, who would later become George III, was the Prince of Wales. At that time, he was only 16 years old and was not very active in promoting knowledge ("George III"). Therefore, it is very likely that the authors chose to dedicate the *Supplement* to him mostly because of his title.

As for the people involved in creating the *Supplement*, the imprint has greatly changed when compared with the fifth edition of Harris's dictionary. In fact, only two people, Mr. Clark and Mr. Bathurst, remained the same, but had a different function now: they had the copyright and distributed Harris's dictionary, but only acted as distributers for the *Supplement*. The anonymous authors owned the copyright, and the new distributers were Mr. Cooper, Mr. Gardner, and one more person, whose name was not readable (see Table 1). Additionally, the phrase "sold by moſt other Bookſellers in Town and Country" indicated that the book was available through the usual channels not only in London, but also in the regional centers (Feather 66). Hence, the *Supplement* was more accessible than Harris's dictionary.

5.2. Lexicographic Archeological Analysis

Edition 1: Volume I (A-Z), 1704

The sample pages were collected in the first edition. No archeological analysis was conducted because there was no earlier edition for comparison.

Edition 2: Volume I (A-Z), 1708

The second edition of Volume I was found to be very similar to the first edition of the same volume. Very few changes in spelling and punctuation were found.

Edition 1: Volume II (A-Z), 1710

The first edition of Volume II followed the second edition of Volume I. From this point and until 1736, there were two series of editions: one for Volume I and the other one for Volume II. I will discuss these two series of editions in the chronological order.

Just as Volume I, Volume II covered the entire alphabet. New sample pages were collected to compare this edition of Volume II with later editions of the same volume. I

attempted to compare Volume II with the second edition of Volume I using the sample pages from Volume I, but found it very difficult because no common terms were found. Because Volume II contained fewer articles and in general they were longer than the articles in Volume I, it seemed more productive to search for the common terms using the sample pages found in Volume II, not Volume I. When the method was altered this way, several common terms were found.

Table 2 contains the changes that were made to the articles that were found both in the second edition of Volume I and in the first edition of Volume II. All of the changes were connected with completely revised definitions. The first type of change, *change of number and a revised definition in a new field*, was used in coding when the grammatical category of number for the entry was changed (plural in the second edition of Volume I, but singular in the first edition of Volume II), the definition was completely revised and discussed an entry from another subject field ("Beams of a ship" in the second edition of Volume I, but "Beam, in any Building" in the first edition of Volume II). *A revised definition in a new field* was used in similar cases, but when the number was not changed. Finally, *a revised definition* was the third type of change and was used when the definition was revised, but the subject field remained the same.

Edition 3: Volume I (A-Z), 1716

The third edition of Volume I was found to be very similar to the second edition of the same volume. Very few changes in spelling and punctuation were found.

Edition 2: Volume II (A-Z), 1723

The second edition of Volume II was also similar to the previous edition of this volume. Very few changes in spelling were found.

Edition 4: Volume I (A-Z), 1725

The fourth edition of Volume I was found to be very similar to the third edition of the same volume. Very few changes in spelling and punctuation were found.

Edition 5: Volume I (A-H) and Volume II (J-Z), 1736

In Edition 5, the two volumes were finally combined in one alphabet and then two new volumes were created: the first contained letters A through H, and the second – letters J through Z.

Changes in the Macrostructure

Table 3 contains the entries that first appeared in the fifth edition. The majority of these entries were labeled according to the subject fields they represented. Entries from the following fields were added: Algebra, Anatomy, Architecture, Aſtrology, Aſtronomy, Botany, Carpentry, Chymiſtry, Fortification, Geometry and Higher Geometry, Gunnery, Heraldry, Law, Levelling, Mathematics, Mechanics, Medicine, Natural History, Optics, Painting, Phyſicks, Rhetoric, and Sea Language.

The entries that were present in the previous editions of Volume I and Volume II, but not in the fifth edition of the dictionary are enumerated in Table 4. In most cases, it was possible to determine the subject field by finding the entry in the Index in the previous edition of Volume I or Volume II. The entries that were deleted came from the following fields: Chymiſtry; Law, Common, Civil, and Cannon; History, Ancient Cuſtoms, & c.; and Navigation and Sea-Terms.

From Table 3 and Table 4, it is clearly seen that the number of entries that were added is much greater than the number of entries that were deleted. The same applies to the subject fields the entries came from.

Changes in the Microstructure

Table 5 contains the changes that were made to the articles that were found both in the fifth edition of the dictionary and in the previous edition of Volume I. Table 6 contains the changes that were made to the articles present in the fifth edition of the dictionary and the previous edition of Volume II.

When the articles found both in the fifth edition of the dictionary and in the previous edition of Volume I were compared, the following types of changes were found. The first type of changes includes definitions that were completely revised; for this type *a revised definition* category was used in coding.

The second group of changes in the microstructure is connected with various types of additional information. When some new information was added to the definition itself, *additional information in the definition* category was used. In some cases, new etymological information was added to the article either preceding the definition of following it (*additional etymological information*). New illustrations, references to other articles, and alternate spelling variants were also added (*an additional illustration*, *an additional reference to another article*, and *alternate spelling*).

The third type of changes was substituted information. In some cases, the previous edition of Volume I contained a complete definition, but the fifth edition provided just a reference to another article (*reference to another article instead of definition*).

The fourth group of changes in the microstructure was connected with deleted information. This group included such category as *a reference to another article deleted*.

When the articles found both in the fifth edition of the dictionary and in the previous edition of Volume II were compared, fewer types of changes were found. From the first group of changes, *a revised definition* category was present. From the second group, *additional information in the definition*, *additional etymological information*, and *an additional illustration* categories were used. No changes connected with substituted information or deleted information were found.

Several articles in the fifth edition of the dictionary were created by using both an article from the previous edition of Volume I and an article from the previous edition of Volume II. In some cases, both articles from the previous editions were included (for example, for "Astronomy," "Nebulous Stars," and "Phalanx"). In other cases, one of the articles was revised. For "Annuity," the fifth edition contains two different entries: the first one comes from the previous edition of Volume I, and the second one is a revised version of an article from the previous edition of Volume II. Further, the articles from the older volumes were combined in one article in the fifth edition (this occurred for such entries as "Annulets," "Cohæsion," "Congruity"). However, in some cases, even though an entry was found both in the previous edition of Volume I and in the previous edition of Volume 2, the choice between the two versions of the article was made, and a longer and more detailed article was chosen ("Conick-sections" and "Conjugate Diameter").

A Supplement to Dr. Harris's Dictionary of Arts and Sciences: 1754

Changes in the Macrostructure

The *Supplement*, as can be expected from the title, mostly included new entries when compared with the fifth edition of the dictionary. However, several common

terms were found (see Table 7). The authors tried to use a system of visuals in order to mark the novelty of entries. They write, "Thoſe Articles mark'd with an Aſteriſm, of which there are above ELEVEN HUNDRED, are entirely new ones, and not to be found in any Performance of the like Nature. Thoſe mark'd thus ☞ are Additions to thoſe under the ſame Title in Dr. HARRIS'S *Lexicon*." As can be seen in Table 7, the authors were inconsistent in their intent.

Changes in the Microstructure

All of the articles describing the terms common for Edition 5 and *A Supplement to Dr. Harris's Dictionary of Arts and Sciences* were completely rewritten, which made it difficult to classify the changes. No additional illustrations were found.

Chapter 6: *The McGraw-Hill Dictionary of Scientific and Technical Terms*

6.1. Cultural Analysis of the Front Matters of All Editions

Edition 1: 1974

As Daniel N. Lapedes, the Editor in Chief, stated in the Preface to the first edition, the purpose of this edition of *The McGraw-Hill Dictionary of Scientific and Technical Terms* (1974) was to "facilitate communication of ideas throughout science and technology." The audience included both specialists and the general public: the dictionary was supposed "to serve scientists and technologists as well as the general public." Creating a dictionary for such a wide audience allowed the publishers to increase the target market.

Lapedes explains that the dictionary appeared for two reasons. First, there was a need for such a specialized reference work because the scientific and technical

vocabulary was not described properly in the general dictionaries of the English language. According to Lapedes, "The vocabulary of science and technology has never been adequately represented in the many general dictionaries of the English language. The *McGraw-Hill Dictionary of Scientific and Technical Terms*, by concentrating solely on this vocabulary, aims to fill this gap."

The second reason why the dictionary appeared at that particular time is the rapid growth of science and technology in the years that preceded the publication of the first edition. Lapedes clarifies,

> Certainly the publication of such a comprehensive scientific dictionary seems long overdue. The growth of science and technology in recent decades has been of astronomical proportions. The fields of nuclear engineering, molecular biology, integrated circuitry, and aerospace are but some of the new disciplines that have evolved. With each new development and as each new discipline has come into being, there has been an expansion of the vocabulary used by workers in these areas to describe the problems in which they have been involved, to communicate inside and outside their fields.

The fields mentioned in the Preface evolved not long before the dictionary was published. Nuclear engineering was developing rapidly in the USA in the 1950s: in 1951, at the Atomic Energy Commission's reactor testing station at Arco, Idaho, a nuclear reactor produced electrical energy from atomic power for the first time (Elliott 285). In 1957, "the first large-scale nuclear power plant in the Unites States" began to function at Shippingport, Pennsylvania (Elliott 298).

Also, there were several important achievements in molecular biology in the 1950s. J. D. Watson and F. H. C. Crick elucidated the structure of DNA in 1953 and the proteins myoglobin and haemoglobin in 1958 and 1959 (Olby 503). Olby pointed out,

> It is this association between structural investigation and genetic mechanisms that gave to the molecular biology of the 1950s its alleged novelty, and justified the claim that here was a new discipline formed out of the fusion of specialisms, and quite unlike anything that had preceded it. This *narrow* conception is in contrast to the *broad* conception of the subject held by those responsible for introducing the term 'molecular biology' in the 1930s and 1940s. (503-504)

In other words, while the term "molecular biology" existed in the 1930s and 1940s, the field was being redefined in the 1950s.

Further, the field of integrated circuitry also appeared not long before the 1970s and was rapidly developing when the dictionary was published. In 1959, Jack Kilby from Texas Instruments and Robert Noyce from Fairchild Semiconductors invented the microchip, "an integrated circuit made of a single silicon wafer" (Ochoa and Corey 322). In the early 1960s, Texas Instruments and Fairchild Semiconductors were the leaders in the semiconductor industry (Sutphen 1939). In 1969, Marcian Edward Hoff, Jr., a research and development engineer from Intel, began to design a special chip called a microprocessor, "which, when combined with a chip to hold the program and one to hold the data, would become a small, general purpose computer" (Sutphen 1940). The first microprocessor, the 4004, came out in 1971 (Sutphen 1940), only three years before the dictionary was published.

The fourth field mentioned in the dictionary Preface, aerospace, was also on the rise in the decades before the dictionary was published. The first satellites were orbited in the 1950s and 1960s: *Sputnik* in 1957; *Explorer I* and *Vanguard I* in 1958; *Explorer IV* in 1959; *Echo I*, the first communication satellite, in 1960; and *Early Bird*, the first commercial satellite, which was intended to transmit television and telephone signals, in 1965 (Elliott 303-316). Moreover, in 1961 Alan Bartlett Shepard, Jr., became the first American in space (Elliott 309), and 1962 was the year both of the first interplanetary exploration as *Mariner 2* passed within 22,000 miles of Venus (Elliott 310), and of the first American orbit of the Earth (Elliott 311). In 1965, the first American spacewalk took place (Elliott 316) and in 1969 the first landing on the Moon occurred. All of these events placed aerospace in the center of attention.

Another theme found in the Preface is the use of the latest technologies in making the dictionary:

> The Dictionary was typeset by the latest technique in graphic arts - computer composition - to provide a method for updating it in future printings. The contents of the Dictionary are stored on magnetic tape masters, which can be readily modified and used to generate the pages of type for subsequent editions. Instead of being ‘frozen’ in content, therefore, this Dictionary will accommodate new terms and definitions as they evolve in the various disciplines. The computer was also an aid in ensuring that technical and scientific terms used in the text of a definition were defined elsewhere in the Dictionary.

Hence, the use of the latest technologies ensured the fluidity of the content of the

dictionary and, in particular, made it easier to keep the reference work up-to-date. IBM introduced the first word processor, the Magnetic Tape/Selectric Typewriter, in 1964 (Elliott 314). Computer designers tried to solve the problem of reliable and inexpensive storage of the data using various technologies. In the early 1940s, Andrew D. Booth had invented "spinning paper disks on which he stored data bay means of punched holes" (Malloy 1923). However, the invention was quickly abandoned because of the engineering problems. Another technology, which quickly became the standard for storing data, was "punched cards and the punched card reader" (Malloy 1923). As Malloy points out, "data were represented on a card by punched holes that corresponded to a letter or command" (1923). After World War II, the magnetic audio tape recorder became the most popular medium for data storage because "the formulation of plastic tape eventually produced sturdy media, and IBM introduced a transport mechanism that used a vacuum to spool out lengths of tape not immediately passed by the read/write head in order to increase transport speed" (Great Events 1924).

Yet another theme that surfaces in the Preface is the switch to the International System of units: "In preparation for the worldwide use of the International System (SI) of units, metric equivalents for U.S. Customary measurement units presently in use are provided in each definition in which the units appear." "SI" stands for French "Système Internationale d'Unités," which is "an international decimal system of weights and measures derived from and extending the metric system of units" ("International System"). At the time the dictionary was published, the metric system was not used in the following countries: Barbados, Liberia, Muscat, Sierra Leone, Nauru, South Yemen, Tonga, Trinidad, and the United States (Branscomb 295). In 1971, three years before

the first edition of the dictionary, Secretary of Commerce Maurice H. Stans introduced to Congress the International Standards Cooperative Act and recommended "that we change to the metric system deliberately and carefully through a coordinated national program; that the Congress establish a target date ten years ahead; and that there be a firm government commitment to this goal" (Branscomb 295). Therefore, the switch to the International System of units was one of the issues discussed in the USA in the early 1970s and reflected in the dictionary Preface.

In the Preface, Lapedes also enumerates several characteristics that make the dictionary stand out. The first characteristic he mentions is comprehensiveness: the dictionary contains "almost" 100,000 definitions and "approximately" 2800 illustrations. Next, the style of definitions is balanced: "The definitions are written in a clear and simple style that is understandable and yet consistent with the level of complexity of the term being defined." Further, Lapedes emphasizes the affordability of the dictionary: "The emphasis in the Dictionary has been placed on providing definitions for terms, rather than on pronunciation, word derivation, and syllabification. Economies derived from this approach have permitted the Dictionary to be published at a more moderate price."

The Preface also contains the description of dictionary compilers. Several groups of people were involved in creating the dictionary. Lapedes points out that contributing editors and the staff of another reference work, *The McGraw-Hill Encyclopedia of Science and Technology*, wrote the definitions (see Table 8). Consulting editors (see Table 9) had a different role: they chose the terms that should be included and the definitions that worked best so that "the terms and the definitions included in the

Dictionary are those considered important in each consultant's particular area of specialization." Library consultants also helped to review definitions.

The editorial staff included the following people:

Daniel N. Lapedes, Editor in Chief

Sybil Parker, Senior Editor

Jonathan Weil, Editor

Edward J. Fox, Art Director

Richard A. Roth, Art Director

Ann D. Bonardi, Art Coordinator

Joe Faulk, Editing Manager

Catherine Engle, Copy Editor

Patricia Walsh, Editing Assistant

William Blaszczak, Editing Assistant

Edition 2: 1978

In the Preface to the next edition, Lapedes, who remained editor in chief, discusses the purpose of this edition: "When the *McGraw-Hill Dictionary of Scientific and Technical Terms* was first published in 1974, its aim was to fill the communications gap created by inadequate representation of the vocabulary of science and technology in general dictionaries of the English language. The second edition continues that purpose, concentrating solely on this vocabulary and thus bringing the most current and specialized terminology to the fingertips of the professional and scientific community as well as the general public with an interest in science." The purpose of the dictionary remained the same, but an appeal to tradition and already established authority (the first

edition) helped to make the second edition more marketable. Just as for the first edition, the audience included both "the professional and scientific community" and the general public.

According to Lapedes, the main reason why the second edition appeared was the need to keep up with the changes in science and technology:

> The volume has since become outdated by the continuing rapid growth in science and technology. With each new development and new discovery, there is an expansion of the vocabulary used by the scientists and researchers to describe the work in which they have been involved. To keep pace with these changes and serve the communication and information needs of all persons interested in or involved with science and technology, the editors of the Dictionary saw the need to publish this expanded and thoroughly up-to-date edition.

The Preface also contains the description of the revision process: "Preparation of the second edition involved a complete review of the Dictionary by the editorial staff and the consulting editors. New and more specialized terms and definitions considered important in each discipline were added; certain areas such as electronics, computer science, physics, and chemistry were given expanded coverage; and other revisions were made as necessary." Hence, more attention was paid to the fields of electronics, computer science, physics, and chemistry in the second edition.

Several important events took place in the fields of electronics and computer science between 1974, when the first edition came out, and 1978, when the second edition was published. In 1975, the first personal computer, the Altair 8800, appeared as

a kit in the USA (Elliott 331). Shortly after that, the Homebrew Computer Club, the first personal computer club, appeared (Ehrhardt 2074). In 1977, the first Apple II was introduced (Elliott 1977), which "launched what was to be a wave of new computers aimed at home and small business markets" (Ehrhardt 2075).

Discoveries were also being made in physics and chemistry. In physics, two groups of researchers simultaneously discovered a subatomic particle that included a charmed quark and a charmed antiquark. Burton Richter called the particle "psi;" Samuel C. C. Ting and associates at the Brookhaven National Laboratory called it "J." For this discovery, both Richter and Ting received the Nobel Prize in physics in 1976 (Elliott 330). In chemistry, the ozone layer came to the center of attention. In 1974, Frank Sherwood Rowland and Mario J. Moline issued a warning that chlorofluorocarbons might contribute to the destruction of the ozone layer (Elliott 330).

The theme of the use of the latest technologies in making the dictionary is again present in the Preface. This time, Lapedes emphasizes that the plan for using the technology described in the first edition actually worked: "The contents of the first edition were stored on magnetic tape masters that were readily modified and used to generate the pages for the second edition. Therefore the Dictionary could easily accommodate new terms and definitions as they evolved in the various disciplines."

Lapedes pointed out the following characteristics of the second edition. First, it was even more comprehensive than the first edition; the second edition contained 108,000 terms and definitions, including "more than 8000 new and revised entries" and "approximately" 3000 illustrations, including 200 new ones. Also, the second edition was up-to-date because it described "the most current and specialized terminology."

Several changes were made to the list of the dictionary compilers. The following people were added to the editorial staff:

Patricia Albers, Senior Editing Assistant

Judith Alberts, Editing Assistant

Dolores Messina, Editing Assistant

Eda Grilli, Art/Traffic

Tables 10 and 11 describe the new people added to the list of contributing editors (Table 10) and consulting editors and library consultants (Table 11).

Edition 3: 1984

The purpose of the third edition published in 1984 remains the same; it is filling "the need created by inadequate representation of the vocabulary of science, engineering, and technology in general English language dictionaries." The audience has not been changed either; the dictionary is produced for the "readers within and outside the scientific community." Overall, little of the Preface was rewritten, but the order of the passages was changed greatly. The author of the Preface was the new Editor in Chief, Sybil P. Parker, who was Senior Editor in the previous editions.

The description of the use of the latest technologies in making the dictionary was deleted from the Preface. This omission could be explained by the fact that the technology that was being used had become more common as computer science kept developing between 1978, when the second edition was published, and 1984, when the third edition came out. In 1981, the IBM Personal Computer was introduced (Elliott 340), which greatly affected the computer marketplace. As Boehlke explains, "the PC, in conjunction with a spreadsheet program and word processing software, gave anyone

within a company, including the corporate executive, the ability to track budgets, run simulations, and prepare reports" (2171). In 1983, IBM introduced a personal computer with a hard disk drive, which gave desktop computers relatively large storage capacities (Malloy 2240), and in 1984, optical disks for the storage of computer data appeared (Nyce 2262). The optical disk technology promised "great strides in storage capacity and reliability as well as competition for magnetically based disk media" (Nyce 2262).

Parker pointed out the following characteristics of the third edition. First, an appeal is made to the status of the reference work: the dictionary is "now a standard international reference." The emphasis on "standard" and "international" demonstrate the popularity and reliability of the dictionary. Second, the dictionary remains a comprehensive reference work: 7500 entries were added, so the third edition includes 98,500 terms with 115,500 definitions, which come from 100 fields. Finally, "special emphasis was given to electronics and computer science since these areas have experienced the most dramatic growth during the past few years."

Several changes were made to the list of the editorial staff, but all consulting and contributing editors stayed the same. The editorial staff consisted of the following people:

Sybil P. Parker, Editor in Chief

Jonathan Weil, Staff Editor

Betty Richman, Staff Editor (new)

Edward J. Fox, Art Director

Ann D. Bonardi, Art Production Supervisor

Cynthia M. Kelly, Art Production Assistant (new)

Joe Faulk, Editing Manager

Ruth L. Williams, Editing Supervisor (new)

Patricia W. Albers, Senior Editing Assistant

Judith Albers, Editing Assistant

Barbara Begg, Editing Assistant (new)

Edition 4: 1989

The fourth edition was published in 1989 and had the same purpose and audience as the previous editions. In terms of the characteristics of this edition, comprehensiveness was again emphasized in the Preface (Parker writes about "the addition of 7600 new entries," "100,100 terms with 117,500 definitions" total, and 102 fields). However, pronunciations for all terms became the added feature: "The fourth edition of the *McGraw-Hill Dictionary of Scientific and Technical Terms*, now a standard international reference, enhanced by the inclusion of pronunciations, continues to serve the information needs of readers within and outside the scientific community."

Several new people joined the editorial staff:

Sybil Parker, Editor in Chief

Arthur Biderman, Senior Editor (new)

Jonathan Weil, Editor

Betty Richman, Editor

Diane Kender Dittrick, Editor (new)

Patricia W. Albers, Editorial Administrator

Edward J. Fox, Art Director

Pablito M. Darden, Designer (new)

Joe Faulk, Editing Manager

Stephen M. Smith, Editing Supervisor (new)

Dianne Walber, Production Supervisor (new)

Dr. Henry F. Beechhold, Pronunciation Editor, Professor of English, Chairman, Linguistics Program, Trenton State College, Trenton, New Jersey (new)

As can be seen from the list, the Pronunciation Editor has the largest number of credentials. This was probably done to establish his authority because pronunciation was a new feature in this edition.

All consulting and contributing editors stayed the same, but the credentials that followed the names (position, organization, field/role in the dictionary) were deleted. This could be explained by the absence of need to establish the editors' authority; by the fourth edition, the dictionary became a trusted authority by itself.

Edition 5: 1994

The fifth edition, which was published in 1994, had a new purpose; the dictionary became "an indispensable tool for the general reader in understanding current developments in science and technology." The audience has changed as well and became the general reader rather than a combination of the general reader and the specialists:

> The primary audience for the work at that time was the body of working scientists and researchers, and the community of professionals who reported on scientific developments; the general reader with an interest in science was then considered a secondary audience. In the course of two decades

> (and through four editions of the work), both the times and the Dictionary have changed. The standards of scientific literacy are higher than ever before, and fluency in the language of science plays an ever more critical role in our society. The vocabulary of science and technology, once the province of the specialist, is now an indispensable component of the general culture.

The change in audience can be explained by the changes that occurred in society. For example, Tietge points out the difference between the status of science in the US right after World War II, and in 1990s and 2000s,

> It was only after the US emerged from World War II as a global superpower that advancements in science and technology became the top priority, and the resulting scramble to feed money into developments in science, engineering, computers, and weapons development was unprecedented. [...] Now, developments in science and technology become less a matter of governmental imperative and more a matter of economic necessity, and the American public has become accustomed to being offered new high-tech products and services relying on cutting-edge science. (21)

By the 1990s, scientific and technical vocabulary truly became part of the general culture.

In the Preface, Parker explains that the fifth edition appeared for two reasons. The first reason is "the increasing importance of scientific terminology in the contemporary world," and the second one is the fast pace of research:

> In addition to the growing prominence of scientific terminology in

> everyday life, the language of science has undergone increasingly rapid changes as the pace of research quickens and entirely new areas of scientific activity rise to prominence. Only a few decades ago, popular opinion held that all the important laws and phenomena were already known, and that all that would engage the scientific community would be ever more precise measurements and more inventive applications of existing knowledge. Recent events in science, however – the creation of whole new technologies, the development of new constructs for well-established fields, and the continuing flow of remarkable discoveries virtually wherever researchers look – have shown that this conventional attitude grossly underestimated human ingenuity and scientific creativity.

Even though measuring the pace of research might seem a rather questionable task, new discoveries and achievements were made between 1989 and 1994. For example, in 1990, the Hubble Space Telescope was placed in orbit around the Earth (Jones 2377). According to Jones, "No telescope can realize its full potential under 100 kilometers of boiling atmosphere which absorbs much of the visible starlight" (2377), so the Hubble Space Telescope made it possible to work around the interference of starlight by the atmosphere of the Earth. Another big-science project of the 1990s was the Human Genome Project, the aim of which was to determine the human genome. In 1992, the maps of two human chromosomes, chromosome 21 and the Y chromosome, were completed (Ochoa and Corey 348).

Comprehensiveness was again singled out as one of the characteristics of the edition: "some" 5000 new terms were added, so the dictionary contains 105,100 terms

with 122,600 definitions. However, it appears that the change of audience was a more important characteristic of the fifth edition.

Several new people joined the editorial staff:

Sybil P. Parker, Editor in Chief

Arthur Biderman, Senior Editor

Jonathan Weil, Editor

Betty Richman, Editor

Patricia W. Albers, Editorial Administrator

Frances P. Licata, Editorial Assistant (new)

Ron Lane, Art Director (new)

Vincent Piazza, Assistant Art Director (new)

Joe Faulk , Editing Manager

Frank Kotowski, Jr., Senior Editing Supervisor (new)

Ruth W. Mannino, Editing Supervisor (new)

Suzanne W. Babeuf, Senior Production Supervisor (new)

Dr. Henry F. Beechhold, Pronunciation Editor

All consulting editors remained the same, but the names of contributing editors, who wrote the definitions, were deleted.

Edition 6: 2003

The sixth edition was published in 2003 and had an altered purpose. As was stated in the Preface, this edition "continues to serve the needs of both the scientific community and the general reader for high-quality information, and to contribute to scientific education and technological literacy." The Prefaces of the previous editions

contained references to scientific education, but the theme of technological literacy appears in the sixth edition for the first time. This could be explained by the rapid technological development and availability of technology for the general user by 2003.

The Preface also contains a detailed discussion of the audience. Licker, the publisher who wrote the preface to this edition, emphasizes the difference in audiences of the first and the sixth editions. According to him, the primary audience for the first edition included specialists and their students: "The first edition of the *Dictionary* was intended primarily for those involved in these developments: the communities of scientific and engineering specialists and their students." He further writes that the audience for the sixth edition is mainly the general public: "However, over the span of subsequent editions, an understanding of the language of science and technology became important if not essential in many areas of commerce and culture, and even in everyday life as we try to make informed decisions about our environment, medical issues, and even the foods we eat. Thus, the audience for this, the sixth edition of the *Dictionary*, has expanded to the nonspecialist needing a comprehensive yet accessible resource for scientific terminology." The audience for the sixth edition is similar to the audience for the fifth edition.

The discussion of audience emphasizes the fact that dictionaries of science are artifacts of scientific and technical writing because they communicate scientific information to a variety of audiences. As can be seen from the discussion above, the audience for *McGraw-Hill Dictionary of Scientific and Technical Terms* changed from the specialists to the general public. *Lexicon Technicum*, on the other hand, was intended for a public readership from the very beginning as the lists of dictionary

subscribers included people of various social statuses and occupations.

In the Preface, the publisher describes the historical contexts of the first and the sixth editions. With regard to the first edition, he writes,

> It was a time when the fruits of research and development in the era following World War II were transforming everyday life in areas ranging from medicine, to transportation, to telecommunications and computing. Humans had already landed on the Moon; the creation of the Internet had begun; the first microprocessors were in operation; and the revolution in molecular biology was underway. English was becoming more and more the common language of scientific research.

Similarly, the rapid development of a number of scientific fields was discussed in the Preface to the first edition.

The context of the sixth edition is somewhat different:

> The language of science and technology is expanding not only in its role in our culture; it is growing in its breadth and depth as scientific disciplines mature and whole new technologies, such as nanotechnology and genomics, arise. The effects of the ready availability of powerful, networked computers and broadband communications have been felt in all areas of science; the pace of scientific discovery and dissemination of information has increased dramatically. The sequencing of the human genome well ahead of the original schedule is a prime example of the accelerating pace of discovery enabled by powerful technologies. Often, the economic and other benefits of scientific and technical advances must be weighed against potential or real

> deleterious consequences, for example in relation to biotechnology, environmental protection, and human health. The need to understand these issues has grown outward from the scientific specialists to educators, journalists, political leaders, and informed citizens.

Here, in addition to new scientific fields, discoveries, and wider audiences, the connection of science with ethics and politics is discussed. This is characteristic of the critical approach, which has been popular at the end of the twentieth century and the beginning of the twenty-first century. For example, see Clark (1987), Kastman Breuch et al. (2002), and Katz (2004) for the discussion of ethics and Blyler (2004), Herndl and Licona (2007), Longo (2006), Slack et al. (2006), and Thralls and Blyler (2002) for the discussion of the political turn, agency, and social action in scientific and technical communication.

According to Licker, there were two main characteristics of the sixth edition: comprehensiveness and modernity. First, “some” 5000 terms were added, so the edition contains 110,000 terms with 125,00 definitions as well as “about” 3000 illustrations and 104 fields. Next, the content was kept up-to-date as “many other terms have been revised as their usage evolves;” “the classification of terminology into fields has also seen changes reflecting more modern usage;” and “other fields have been kept, but their definitions updated as these sciences evolve.” Similarly, a lot of illustrations “were replaced with modern examples.”

The main change in the editing staff was the replacement of the Editor in Chief by the Publisher. As in previous editions, several new people joined the editing staff:

> Mark D. Licker, Publisher - Science (new)

Elizabeth Geller, Managing Editor (new)

Jonathan Weil, Senior Staff Editor

David Blumel, Staff Editor (new)

Alyssa Rappaport, Staff Editor (new)

Charles Wagner, Digital Content Manager (new)

Renee Taylor, Editorial Assistant (new)

Roger Kasunic, Vice President - Editing, Design, and Production (new)

Joe Faulk, Editing Manager

Frank Kotowski, Jr., Senior Editing Supervisor

Ron Lane, Art Director

Vincent Piazza, Assistant Art Director

Thomas G. Kowalczyk, Production Manager (new)

Pamela A. Pelton, Senior Production Supervisor (new)

Henry F. Beechhold, Pronunciation Editor

There are two lists of consulting editors: one with the names of people who worked on previous editions (this list remained the same) and one with the names of those who worked on the sixth edition:

Dr. Milton B. Adesnik

Robert D. Briskman

Dr. Orlando J. Miller

Dr. Kenneth P. H. Pritzker

As in the two previous editions, the credentials that followed the names (position, organization, field/role in the dictionary) were not present.

6.2. Lexicographic Archeological Analysis

Edition 1: 1974

The sample pages were collected in the first edition. No archeological analysis was conducted because there was no earlier edition for comparison.

Edition 2: 1978

Changes in the Macrostructure

Table 12 contains the entries that were added in the second edition. As can be seen in the table, a number of new entries did not have a clearly stated subject field; however, the majority of them were labeled. Entries from the following fields were added in the second edition of the dictionary: acoustics, automatic data processing, agriculture, architecture, astronomy, atomic physics, biochemistry, building construction, chemistry, chemical engineering, communications, control systems, cytology, design engineering, electricity, electronics, electromagnetism, engineering, fluid mechanics, graphics, inorganic chemistry, materials, mathematics, mechanical engineering, medicine, metallurgy, microbiology, mining engineering, mineralogy, mycology, navigation, nucleonics, optics, ordnance, organic chemistry, particle physics, petroleum engineering, pharmacology, physics, physical chemistry, solid-state physics, and thermodynamics.

The entries that were present in the first edition of the dictionary, but not in the second edition, are enumerated in Table 13. Some of them were not labeled in the first edition, but for most of them the subject field was stated. The entries that were deleted came from the following fields: chemistry, communications, electricity, engineering, immunology, mathematics, microbiology, mining engineering, navigation, ordnance,

and pharmacology.

Changes in the Microstructure

Table 14 contains the changes that were made to the articles that were found both in the first and the second editions. The following types of changes were found. The first group of changes covers definitions that were completely revised: *a revised definition and a revised subject field* (the definition was revised, and the subject field the entry belonged to was changed as well), *a revised definition*, and *change of number and a revised definition* (the definition was revised, and the grammatical category of number of the entry was changed either from singular to plural or from plural to singular).

The second group of changes in the microstructure is connected with various types of additional information. In some cases, a new meaning or several meanings were added in an existing subject field or in a new subject field, which led to such categories as *an additional meaning in an additional subject field*, *several additional meanings in an additional subject field*, *several additional meanings in several additional subject fields*, and *an additional meaning in an existing subject field*. In other cases, the name of the subject field was stated (*an additional name of the subject field*), and some new information was added to the definition itself (*additional information in the definition*). New synonyms and an illustration were also added (*additional synonym(s)* and *an additional illustration*), and illustration descriptions were sometimes added or updated (*additional and/or updated illustration description*).

The third group of changes in the microstructure of the second edition of the dictionary was substituted information. In some cases, the first edition contained just a

reference to another article, but the second edition provided a complete definition for the same entry (*definition instead of reference to another article*) and vise versa (*reference to another article instead of definition*).

The fourth group of changes in the microstructure was connected with deleted information. This group included such categories as *one definition deleted*, *part of the definition deleted*, *part of the illustration description deleted*, *a reference to another article deleted*, *a synonym deleted*, and *an illustration deleted*.

The last type of changes in the microstructure of the dictionary was *altered order of definitions*. This category was used in coding when the order of definitions in an article was reversed.

Edition 3: 1984

Changes in the Macrostructure

Table 15 contains the entries that first appeared in the third edition. As in the second edition, the majority of these entries were labeled according to the subject fields they represented. Entries from the following fields were added: aerospace engineering, architecture, astronomy, biochemistry, biology, botany, building construction, chemistry, chemical engineering, civil engineering, communications, computer science, cryogenics, crystallography, design engineering, ecology, electricity, electronics, engineering, engineering acoustics, fluid mechanics, food engineering, forestry, genetics, geography, geology, geophysics, graphic arts, hydrology, immunology, mapping, materials, mathematics, mechanical engineering, medicine, metallurgy, meteorology, mining engineering, mineralogy, molecular biology, nucleonics, nuclear physics, oceanography, organic chemistry, petrology, petroleum engineering, physics,

physical chemistry, physiology, plant pathology, plasma physics, relativity, solid-state physics, spectroscopy, systems engineering, textiles, and thermodynamics.

The entries that were present in the second edition of the dictionary, but not in the third edition, are enumerated in Table 16. The subject field was stated in all cases. The entries that were deleted came from the following fields: biology, immunology, invertebrate zoology, geology, metallurgy, microbiology, and textiles.

Changes in the Microstructure

Table 17 contains the changes that were made to the articles that were found both in the second and the third editions. The following types of changes were found. The first group of changes covers definitions that were revised: *grammar corrected in the definition* (in the second edition, the entry was in singular while the key word of the definition was in plural, but in the third edition both the entry and the key word of the definition were in singular) and *a revised definition*.

The second group of changes in the microstructure is connected with various types of additional information. Just as in the second edition, when a new meaning or several meanings were added in an existing subject field or in a new subject field, the following categories were used: *an additional meaning in an additional subject field, several additional meanings in an additional subject field, several additional meanings in several additional subject fields,* and *an additional meaning in an existing subject field*. New synonyms were also added (*additional synonym(s)*).

The third group of changes in the microstructure of the third edition of the dictionary was deleted information. This group included such categories as *one definition deleted* and *an illustration deleted*.

The last type of changes in the microstructure of the dictionary was *altered order of definitions*. This category was used in coding when the order of definitions in an article was reversed.

Edition 4: 1989

Changes in the Macrostructure

The entries that first appeared in the fourth edition are enumerated in Table 18. As in all previous editions, the majority of these entries were labeled according to the subject fields. Entries from the following fields were added: acoustics, archeology, astronomy, atomic physics, biochemistry, biology, botany, chemical engineering, communications, computer science, control systems, cryogenics, ecology, electricity, electronics, electromagnetism, engineering, graphic arts, hydrology, industrial engineering, invertebrate zoology, materials, mathematics, mechanics, mechanical engineering, medicine, metallurgy, meteorology, microbiology, molecular biology, navigation, naval architecture, nucleonics, nuclear physics, oceanography, optics, particle physics, petroleum engineering, physics, physical chemistry, spectroscopy, virology, and zoology.

Table 19 contains the entries that were present in the third edition of the dictionary, but not in the fourth edition. In some cases, the subject field was not stated, but the entries that were labeled came from the following fields: analytical chemistry, biology, chemical engineering, communications, electronics, engineering, graphic arts, invertebrate zoology, microbiology, mycology, organic chemistry, petrology, and textiles.

Changes in the Microstructure

Table 20 contains the changes that were made to the articles that were found both in the third and the fourth editions. Several types of changes were found. The first group of changes is connected with revised information: in some cases, definitions were rewritten (*a revised definition*); in other cases, illustrations were altered (*an altered illustration*).

The second group of changes in the microstructure covers various types of additional information. The following categories were used for additional meanings: *an additional meaning in an additional subject field*, *several additional meanings in an additional subject field*, *several additional meanings in several additional subject fields*, and *an additional meaning in an existing subject field*. Other types of changes included *additional information in the definition*, *additional synonym(s)*, *an additional illustration*, and *an abbreviation explained*.

The third group of changes in the microstructure of the fourth edition of the dictionary was substituted information. If the third edition contained a complete definition, but the fourth edition provided just a reference to another article, the category *reference to another article instead of definition* was used.

The fourth group of changes in the microstructure was connected with deleted information. This group included such categories as *part of the definition deleted*, *a synonym deleted*, and *an illustration deleted*.

The last type of changes in the microstructure of the dictionary was *altered order of definitions*. This category was used in coding when the order of definitions in an article was reversed.

Edition 5: 1994

Changes in the Macrostructure

Table 21 contains the entries that were added in the fifth edition. As in the previous editions, the majority of entries were labeled. They represented the following subject fields: acoustics, analytical chemistry, astronomy, astrophysics, biochemistry, biology, botany, building construction, civil engineering, chemistry, chemical engineering, civil engineering, communications, computer science, control systems, cytology, design engineering, ecology, electricity, electronics, engineering, evolution, fluid mechanics, food engineering, genetics, geology, geophysics, graphic arts, immunology, industrial engineering, materials, mathematics, mechanics, mechanical engineering, medicine, metallurgy, molecular biology, mycology, nucleonics, nuclear physics, optics, organic chemistry, particle physics, petroleum engineering, physics, physical chemistry, physiology, psychology, relativity, statistics, textiles, thermodynamics, and virology.

The entries that were present in the fourth edition, but not in the fifth edition of the dictionary are enumerated in Table 22. Several entries were not labeled, but the rest of them were terms from aerospace engineering, mathematics, and mineralogy.

Changes in the Microstructure

Table 23 contains the changes that were made to the articles that were found both in the fourth and the fifth editions. The following types of changes were found. The first group of changes is connected with definitions that were revised and included such categories as *a separate entry becomes one of the meanings* (this category was used when a separate article from the fourth edition became one of the meanings in a larger

article in the fifth edition), *a revised definition and a revised subject field*, and *a revised definition*.

The second group of changes in the microstructure covers various types of additional information. One of the types was *subject field stated*. The following categories were used for additional meanings: *an additional meaning in an additional subject field*, *several additional meanings in an additional subject field*, *several additional meanings in several additional subject fields*, *an additional meaning in an existing subject field*, and *several additional meanings in an existing subject field*. Other types of changes included *additional synonym(s)*, and *an additional illustration*.

The third group of changes in the microstructure of the fifth edition of the dictionary was substituted information. In particular, the category *reference to another article instead of definition* was used.

The fourth group of changes in the microstructure was connected with deleted information. This group included such categories as *one definition deleted*, *part of the definition deleted*, *part of the illustration description deleted*, and *an illustration deleted*.

The last two types of changes in the microstructure of the dictionary were *altered order of definitions* and *altered order of synonyms*. The former category was used in coding when the order of definitions was reversed in an article; the latter category was used when the order of synonyms was changed.

Edition 6: 2003

Changes in the Macrostructure

The entries that were added in the sixth edition are enumerated in Table 24. The

majority of entries were labeled. They represented the following subject fields: aerospace engineering, astronomy, atomic physics, biochemistry, biology, biophysics, botany, cell and molecular biology, chemistry, communications, computer science, control systems, ecology, electronics, electromagnetism, embryology, engineering, engineering acoustics, evolution, fluid mechanics, food engineering, genetics, geophysics, graphic arts, histology, immunology, industrial engineering, invertebrate zoology, marine engineering, materials, mathematics, mechanics, mechanical engineering, medicine, meteorology, microbiology, mineralogy, molecular biology, mycology, navigation, naval architecture, oceanography, optics, organic chemistry, physics, physiology, psychology, quantum mechanics, statistics, solid-state physics, systems engineering, vertebrate zoology, and virology.

Table 25 contains the entries that were present in the fifth edition of the dictionary, but not in the sixth edition. These entries came from the following fields: astronomy, communications, computer science, genetics, medicine, particle physics, and spectroscopy.

Changes in the Microstructure

Table 26 contains the changes that were made to the articles that were found both in the fifth and the sixth editions. The first group of changes is connected with revised information and included such categories as *a revised definition and a revised subject field*, *a revised definition*, *an altered illustration*, and *altered illustration description*.

The second group of changes in the microstructure covers various types of additional information. The following categories were used for additional meanings: *an additional meaning in an additional subject field, several additional meanings in an*

additional subject field, *several additional meanings in several additional subject fields*, and *an additional meaning in an existing subject field*. Other types of changes included *additional information in the definition*, *additional synonym(s)*, and *an additional illustration*.

The third group of changes in the microstructure of the sixth edition of the dictionary was substituted information. For example, a definition was used instead of reference to another article (*definition instead of reference to another article*).

The fourth group of changes in the microstructure was connected with deleted information. This group included such categories as *one definition deleted*, *part of the definition deleted*, *part of the illustration description deleted*, *a synonym deleted*, and *an illustration deleted*.

The last type of changes in the microstructure of the dictionary was *altered order of definitions*.

Chapter 7: Discussion

As participants in knowledge making and as products of capitalism, dictionaries function in the production-consumption cycles. I will now discuss how Harris's *Lexicon Technicum* does that.

7.1. *Lexicon Technicum*

The first cycle was connected with the *Proposal* that was published in 1702. Figure 3 is a production-consumption model of the step. The circle on top represents the center where all the information for the dictionary was collected. This center "disseminate[s] systems of rules, conventions, and practices that condition the creation, circulation, and use of resources, information, knowledge, and belief" (Leitch 128). In

Latour's words, this center also "dominat[es] at a distance many other places" (223).

The cycle at the bottom is production cycle 0 because no dictionary edition is produced at this point. Instead, a *Proposal* is created, which helps advertise the dictionary and get the subscribers for the first edition of Volume I of the dictionary. Creating the *Proposal* during production cycle 0 helps get ready for consumption cycle 1, during which the first edition of Volume I is sold and used by the public (see Figure 3).

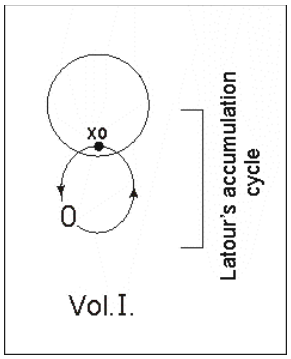


Figure 3. Production-Consumption Model of the First *Proposals*.

Figure 4 is a production-consumption model of the first edition of Volume I of *Lexicon Technicum*. This edition was published in 1704. The circle in the middle represents the "center," which included John Harris (the dictionary compiler) and the people who owned the copyright and distributed the dictionary (see Table 1).

After Harris collected the material for the dictionary, the first edition of Volume I was published (X1 in the figure; production cycle 1 was completed). During this cycle, all the information necessary for creating the word list of the dictionary was collected and brought to the center.

At the same time, during production cycle 1, the dictionary compilers were getting ready for the consumption cycles that followed, during which the dictionary would be

distributed. For example, the list of subscribers for the first edition of Volume I was created and published in the same volume. Additionally, in order to make sure that the dictionary was commercially successful, several important moves were made in the front matter of this edition. First, the content of the dictionary was legitimized by providing the information about the author, using different languages, and referring to the King, the Royal Society in general and Newton in particular. Second, Harris emphasized that the dictionary helps create the corpus of complete knowledge by discussing not only words, but "things" and by being very comprehensive.

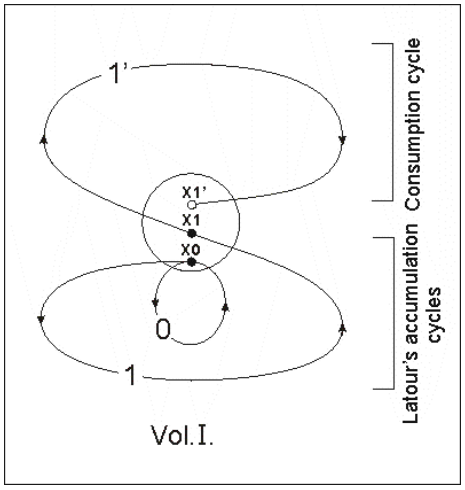


Figure 4. Production-Consumption Model of Edition 1, Volume I, *Lexicon Technicum*.

Next, the first edition of Volume I was sold and used by the public (consumption cycle 1' is completed). At this stage, the subscribers that were on the list received the dictionary. During this cycle, some additional information that potentially could lead to a new dictionary edition (X1') could have been collected. However, at this point, this edition was not realized. The rectangle around the cycles represents the context, in which the first edition of Volume I was created and sold. The analysis of the front matter demonstrates the close connection of the dictionary with the cultural context.

Figure 5 is the production-consumption model of the second edition of Volume I, which was published in 1708. The "center" included the same author (John Harris), but there were several changes in the imprint that contained the list of the people who owned the copyright and distributed the dictionary (see Table 1). Some new information consisting of minor changes in spelling and punctuation was added to the first edition of Volume I (production cycle 2), which leads to the second edition (X2), so production cycle 2 is completed.

In addition, during production cycle 2, the second edition of Volume I was prepared for consumption cycle 2', during which this book would be sold. In order to make this edition commercially successful, the same moves were made in the front matter of this edition of Volume I as in the front matter of the first edition. The second edition of Volume I was then distributed and used by the public (consumption cycle 2').

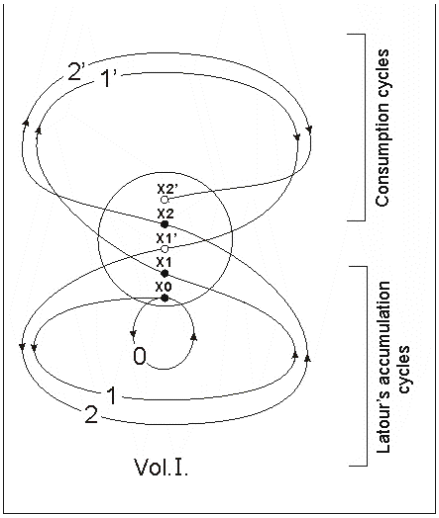


Figure 5. Production-Consumption Model of Edition 2, Volume I, *Lexicon Technicum*.

Figure 6 is the production-consumption model of the second *Proposals*. Harris used this document to advertise both the second edition of Volume I and the first edition of Volume II in 1707. However, only Volume II contained a new list of subscribers, so

it remains unclear whether this proposal was successful as an advertisement for the second edition of Volume I. The circle on top represents the center where all the information about Volume II of *Lexicon Technicum* was collected. Also, this center is different from the center for Volume I because a new book is being created, which will lead to a new series of editions different from the editions of Volume I.

Just as in the model of the first *Proposals*, the cycle at the bottom is production cycle 0 because no dictionary edition is produced at this point. Instead, the second proposal is created, which helps advertise the dictionary and get the subscribers for the second edition of Volume II. Therefore, creating the proposal during production cycle 0 helps get ready for consumption cycle 1, during which the first edition of Volume II is distributed and used by the public (see Figure 6).

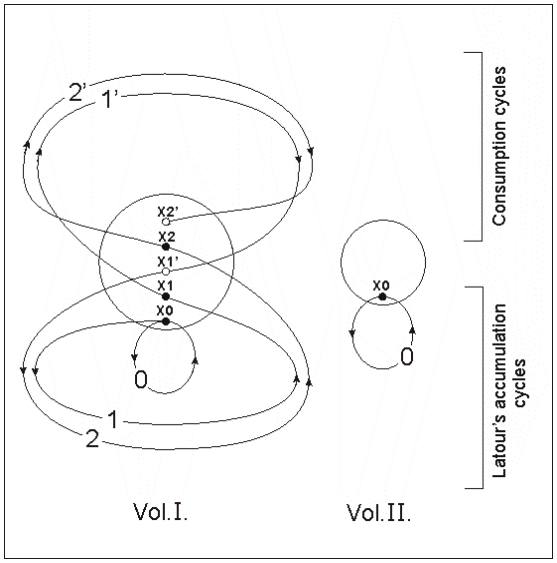


Figure 6. Production-Consumption Model of the Second *Proposals*.

Next, Volume II of *Lexicon Technicum* is created in 1710. Figure 7 is the production-consumption model of the first edition of this volume. As I explained above, the center is different from the center for Volume I because a new book is being

created. Also, the center still includes the author (John Harris) and the people who had the copyright and distributed this edition (see Table 1).

After Harris collected the material for this edition, the first edition of Volume II was published (X1 in the figure; production cycle 1 was completed). During this cycle, all the necessary information was brought to the center. Production cycle 1' of Volume II overlaps production cycles 1' and 2' of Volume I because, as the archeological analysis showed, even though most of the information provided in the first edition of Volume II was new, several terms common for this edition of Volume II and for the second edition of Volume I were found. However, all of the definitions were still completely rewritten, which demonstrates an attempt to provide as much new information as possible and, therefore, create a "complete" corpus of knowledge.

At the same time, during production cycle 1, the dictionary was prepared for the consumption cycles that followed. For example, the list of subscribers for the first edition of Volume II was created and published in the same volume. Additionally, several important moves were made in the front matter of this edition. Even though the front matter was rewritten, the moves were similar to the ones from the front matter of Volume I. First, the content of the dictionary was legitimized by providing the updated information about the author, by using different languages, and by referring to the King, the Lord High-Chancellor of Great Britain, the Royal Society in general and Newton in particular. Second, Harris emphasized that the dictionary helps create a complete corpus of knowledge because Volumes I and II complement each other and can be treated like a complete library.

Next, the dictionary was distributed and used by the public (consumption cycle 1'

is completed). At this stage, the subscribers who were on the list published in the dictionary received Volume II. Consumption cycle 1’ of Volume II overlaps consumption cycles 1’ and 2’ of Volume I because, as the analysis of the subscribers’ lists showed, some of the subscribers bought both volumes. Therefore, in many cases, the consumption cycles of Volume I and the consumption cycles of Volume II shared part of the market.

Just as in all other production-consumption models used in this study, the rectangle around the cycles represents the context in which this particular edition was created and distributed. The analysis of the front matter demonstrates the close connection of the dictionary with the cultural context.

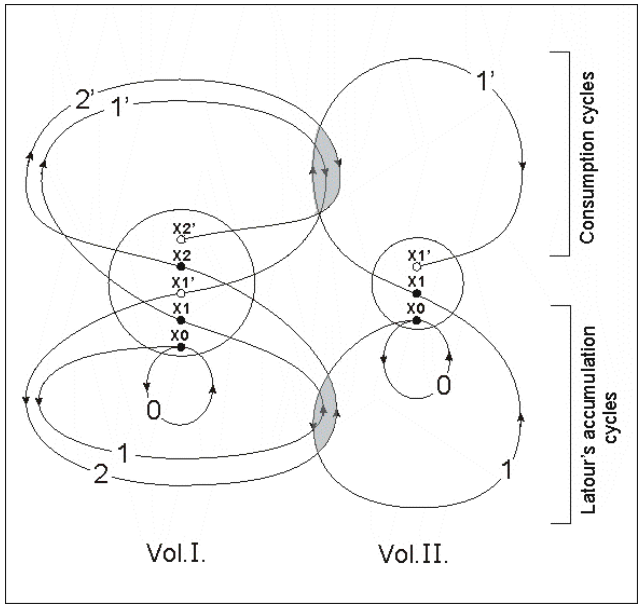


Figure 7. Production-Consumption Model of Edition 1, Volume II, *Lexicon Technicum*.

Further, Figure 8 is the production-consumption model of the third edition of Volume I, which was published in 1716. The “center” included the same author (John Harris), and Table 1 demonstrates the changes in the imprint that contained the list of

the people who owned the copyright and distributed the dictionary. Some new information consisting of minor changes in spelling and punctuation was added to the second edition of Volume I (production cycle 3), which leads to the third edition (X3), so production cycle 3 is completed.

In addition, during production cycle 3, the third edition of Volume I was prepared for consumption cycle 3'. In order to make this edition commercially successful, the same moves were made in the front matter of this edition of Volume I as in the front matter of the first and the second editions. The third edition of Volume I was then distributed and used by the public (consumption cycle 3').

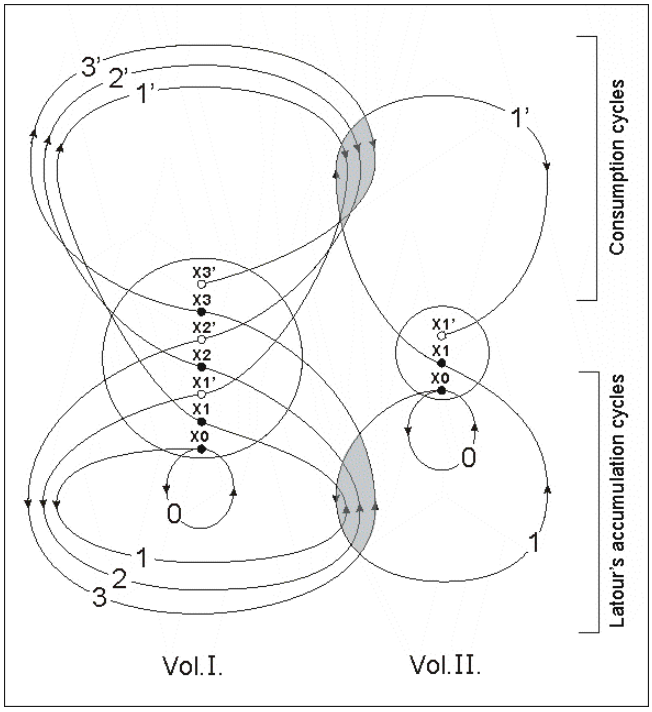


Figure 8. Production-Consumption Model of Edition 3, Volume I, *Lexicon Technicum*.

Chronologically, the next edition was the second edition of Volume II. It was published in 1723. Figure 9 is the production-consumption model of this edition. It still had the same author in the "center," but there were several changes in the imprint that

contained the list of the people who owned the copyright and distributed the dictionary (see Table 1). Some updated information about John Harris was added to the first edition of Volume II (production cycle 2). This led to the second edition (X2), so production cycle 2 was completed. Because this edition of Volume II was so similar to the previous edition of the same volume and all editions of Volume I were also alike, the production cycles for Volume I and Volume II still overlapped. The same moves were made in the front matter of this edition as in the front matter of the previous edition of Volume II in order to prepare the dictionary for the consumption cycles that followed. The second edition of Volume II was then distributed and used by the public (consumption cycle 2').

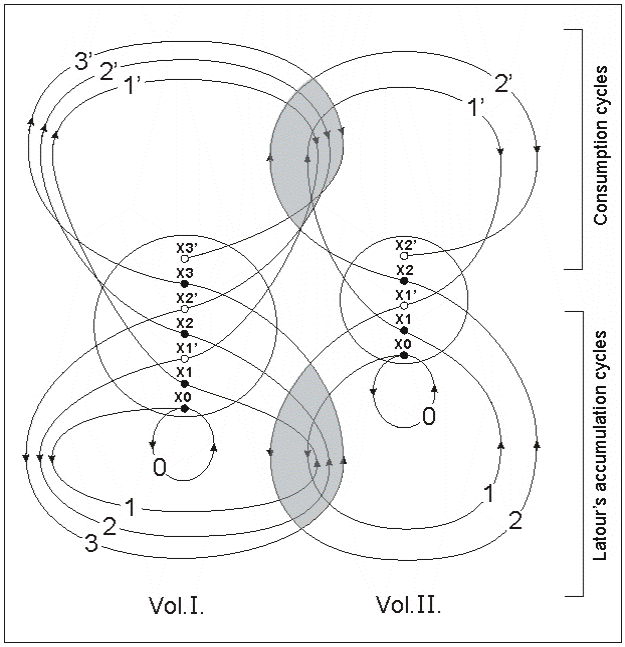


Figure 9. Production-Consumption Model of Edition 2, Volume II, *Lexicon Technicum*.

The fourth edition of Volume I was published in 1725. Figure 10 is its production-consumption model. The description of how this edition functions in the production-consumption cycles is very similar to that of the third edition of Volume I.

The fifth edition, which was published in 1736, marked a new stage in the history of *Lexicon Technicum*. In this edition, Volume I and Volume II that functioned as separate dictionaries each describing the entire alphabet, were finally combined into one dictionary. This dictionary still consisted of two volumes, but because the first one contained letters A through H and the second – letters J through Z, the reference work would be "complete" only with both volumes present. This was also proved by the fact that only the first volume had a front matter; the second one began with the wordlist and, therefore, was meant to be seen as "continuation" of the first volume.

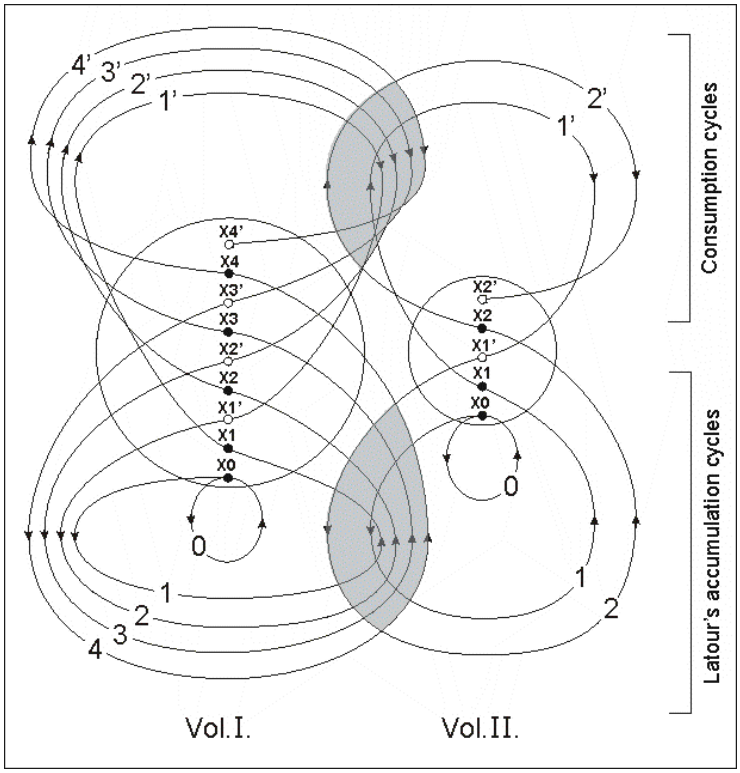


Figure 10. Production-Consumption Model of Edition 4, Volume I, *Lexicon Technicum*.

Figure 11 is the production-consumption model of the fifth edition of *Lexicon Technicum*. The center is different from the centers for all previous editions of the dictionary because a new book is being created. Also, the center still includes the author

(the dictionary is still attributed to John Harris). However, when this edition was being compiled, all of the decisions regarding the changes to the dictionary were made by anonymous "Editors." Therefore, the Editors were also in the center. Finally, the people who had the copyright and distributed this edition are listed in Table 1.

Because the fourth edition of Volume I and the second edition of Volume II were used as the basis for this edition, the original "point" that marked the beginning of the production cycle for the fifth edition is labeled as "X4'(I) +X2'(II)." The points "X4'" and "X2'" can also be found in Figure 10. During production cycle 5 (see Figure 11), the Editors combined the two volumes, added some information, and brought it all to the center. After that, the fifth edition was published (X5 in the figure; production cycle 5 was completed). The types of new information included additional entries from a number of subject fields, completely rewritten definitions, various types of additional information in the articles, and substituted information in the articles. Adding new information helped contribute to the corpus of knowledge that was being formed at that time.

At the same time, during production cycle 5, the dictionary was prepared for the consumption cycles that followed. Several important moves were made in the front matter of this edition. Because most of the front matter was a combination of the front matters from the previous edition of Volume I and the previous edition of Volume II, the moves in that part of the text remained the same. However, the Editors also made a choice regarding which Dedication to include. By choosing to use the Dedication to the King, they legitimized the information found in the dictionary by using the King's name. Also, they added some new text to the front matter. In this part, they emphasized

that this edition would add to the existing corpus of knowledge by providing a lot of additional information.

Next, the dictionary was distributed and used by the public (consumption cycle 5' is completed).

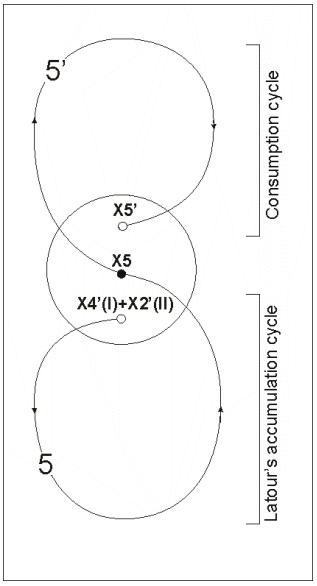


Figure 11. Production-Consumption Model of Edition 5, Volume I, *Lexicon Technicum*.

The last book in the *Lexicon Technicum* series was *A Supplement to Dr. Harris's Dictionary of Arts and Sciences* published in 1754. Figure 12 is the production-consumption model of the *Supplement*. The center is different from the centers on all models discussed above because a new book is being created. Also, the *Supplement* was compiled by a different group of people ("A Society of Gentlemen"), and many changes were made to the list of people who had the copyright and distributed the book (see Table 1).

After the compilers collected the material for the *Supplement*, the book was published (X1 in the figure; production cycle 1 was completed). During this cycle, all the necessary information was brought to the center. As can be expected from the title

of the book, most of the terms were the ones not present in the fifth edition of *Lexicon Technicum*, and even the common ones had entirely new definitions, which demonstrates an attempt to provide as much new information as possible and, therefore, create a "complete" corpus of knowledge.

At the same time, during production cycle 1, the *Supplement* was prepared for the consumption cycles that could follow, during which the dictionary would be distributed. In particular, the compilers legitimized the information found in the dictionary using the authority of the Prince of Wales in the Dedication and emphasized in the Preface that the *Supplement* would add to the existing corpus of knowledge by providing a lot of additional information.

Finally, the *Supplement* was distributed and used by the public (consumption cycle 1' is completed).

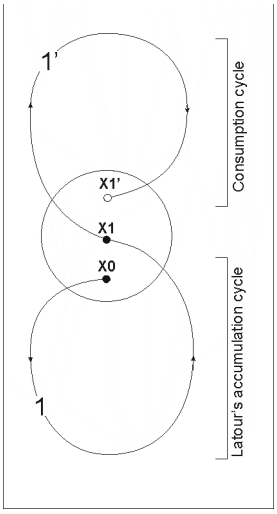
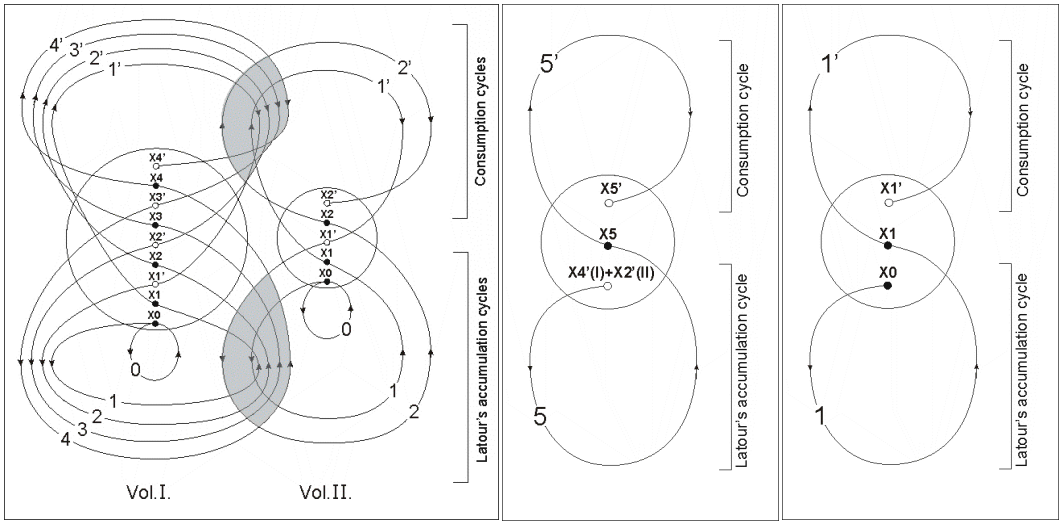


Figure 12. Production-Consumption Model of the *Supplement*.

As can be seen in Figure 13, the history of *Lexicon Technicum* can be subdivided into three phases. During Phase I, Volume I and Volume II functioned as two relatively autonomous dictionaries that in some cases overlapped in terms of the users and the

information provided in the dictionaries, but overall complemented each other. During Phase II, the two volumes were combined, and some new information was also added, which led to the appearance of the dictionary consisting of two volumes, but in this case the volumes formed a complete reference work. During Phase III, another book was added to form a "library" together with the dictionary created during Phase II.

It should also be noted that the production-consumption models are abstract. The production cycles may have been more productive than the consumption cycles, which would make the former appear larger than the latter. However, that is not reflected in the models because of their abstract nature.



Phase I. Phase II. Phase III.

Figure 13. Phases of *Lexicon Technicum*.

The main characteristic of the scientific knowledge economy in which *Lexicon Technicum* functioned is adding large volumes of new information (entire books, for example, in the case of Volume II during Phase I and the *Supplement* during Phase III). This can be interpreted as an attempt to form a "complete" corpus of knowledge. The

idea of forming such corpus is also often used in the front matters of the dictionary to increase the book's marketability and was common for the cultural context of that time. Other characteristics of the scientific knowledge economy in which *Lexicon Technicum* functioned include publication by subscription, unstable centers where all the information for the dictionary was collected, and legitimation of the dictionary by providing information about the author, using different languages, and referring to the King, the nobility, the Royal Society, and Newton.

7.2. *McGraw-Hill Dictionary of Scientific and Technical Terms*

I will now describe how each edition of *McGraw-Hill Dictionary of Scientific and Technical Terms* functions in the production-consumption cycles.

Figure 14 is a production-consumption model of the first edition of this dictionary. The circle in the middle represents the "center," which includes the institution that published the dictionary and, therefore, "disseminate[s] systems of rules, conventions, and practices that condition the creation, circulation, and use of resources, information, knowledge, and belief" (Leitch 128). McGraw-Hill Book Company is the institution for all 6 editions of the dictionary, but the major power players within the company changed with each edition. For the first edition, they included the editorial staff, contributing editors, the staff of *The McGraw-Hill Encyclopedia of Science and Technology*, consulting editors, and library consultants.

After the compilers collected the material for the dictionary, the first edition was published (X1 in the figure; production cycle 1 was completed). During this cycle, all the information necessary for creating the word list of the dictionary was collected and brought to the center. At the same time, during production cycle 1, the dictionary

compilers were getting ready for consumption cycle 1', during which the first edition of the dictionary would be sold. In order to make sure the dictionary was commercially successful, several important topics were discussed in the front matter of the dictionary. These topics included the rapid growth of science and technology in the years that preceded the publication of the dictionary, the use of the latest technologies in making the dictionary, and some of the characteristics that make the dictionary stand out, namely, comprehensiveness, a balanced style of definitions, and affordability. The focus was on the development of science and technology rather than on creating a "complete" corpus of knowledge.

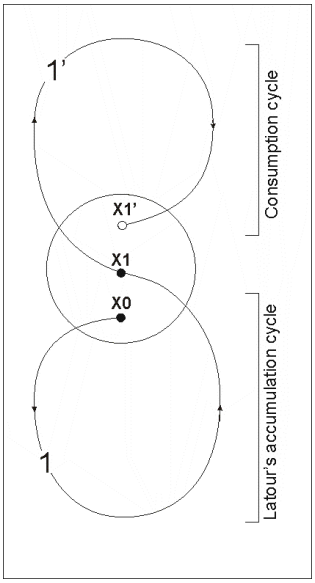


Figure 14. Production-Consumption Model of Edition 1, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Next, the first edition was sold and used by the public (consumption cycle 1' is completed). During this cycle, some additional information that potentially could lead to a new dictionary edition (X1') could have been collected. However, at this point, this edition was not realized. The rectangle around the cycles represents the context, in

which the first edition was created and sold. The analysis of the Preface demonstrates the close connection of the dictionary with the cultural context, in which the book was created.

Figure 15 is the production-consumption model of the second edition of the dictionary. While the same publisher remains in the center, there were several changes in the staff. More information is added to the first edition (production cycle 2), which leads to the second edition (X2), so production cycle 2 is completed. The types of new information included additional entries from a number of subject fields, completely rewritten definitions, various types of additional information in the articles, substituted information in the articles, and altered order of definitions in the articles.

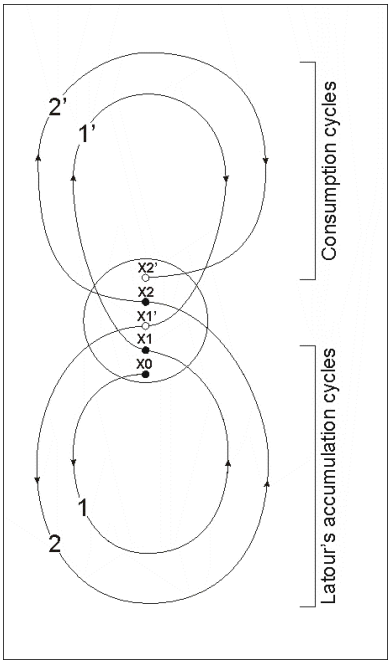


Figure 15. Production-Consumption Model of Edition 2, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

In addition, during production cycle 2, the second edition of the dictionary was prepared for consumption cycle 2'. In order to make this edition commercially

successful, the following topics were discussed in the front matter: the need to keep up with the changes in science and technology, the description of the revision process, the use of the latest technologies in making the dictionary, and some of the characteristics that make the dictionary stand out, namely, comprehensiveness and modernity. Again, the emphasis was on the progress in science and technology rather than on getting closer to the complete volume of scientific knowledge. The second edition is then sold and used by the public (consumption cycle 2'). Just as in the models of all editions of this dictionary, the rectangle represents the context, in which the edition was created and sold.

Further, Figure 16 is the production-consumption model of the third edition of the dictionary. Again, the center includes the same publisher, but there were several changes in the staff. More information is added to the second edition (production cycle 3), which leads to the third edition (X3), so production cycle 3 is completed. The types of new information included additional entries from a number of subject fields, completely rewritten definitions, various types of additional information in the articles, and altered order of definitions in the articles.

Also, during production cycle 3, the third edition of the dictionary was prepared for consumption cycle 3', during which this edition would be sold. In order to make this edition commercially successful, the following topics were discussed in the front matter: the need to keep up with the changes in science and technology, the description of the revision process, and some of the characteristics of this particular edition, namely, its comprehensiveness and status as a standard international reference. Again, the emphasis was not on forming a complete corpus of knowledge. The third edition is

then sold and used by the public (consumption cycle 3').

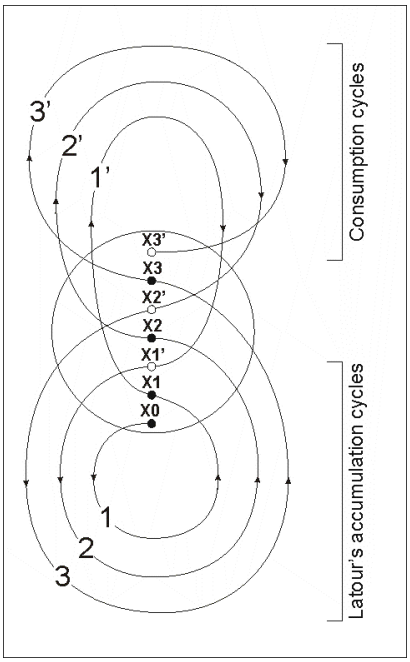


Figure 16. Production-Consumption Model of Edition 3, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

The production-consumption model of the fourth edition of the dictionary is represented by Figure 17. The publisher has not changed, so the institution represented in the circle in the middle is still the same even though there were several changes in the staff. More information is added to the third edition (production cycle 4), which leads to the fourth edition (X4), so production cycle 4 is completed. The types of new information included additional entries from a number of subject fields, completely rewritten definitions, altered illustrations, various types of additional information in the articles, substituted information in the articles, and altered order of definitions in the articles.

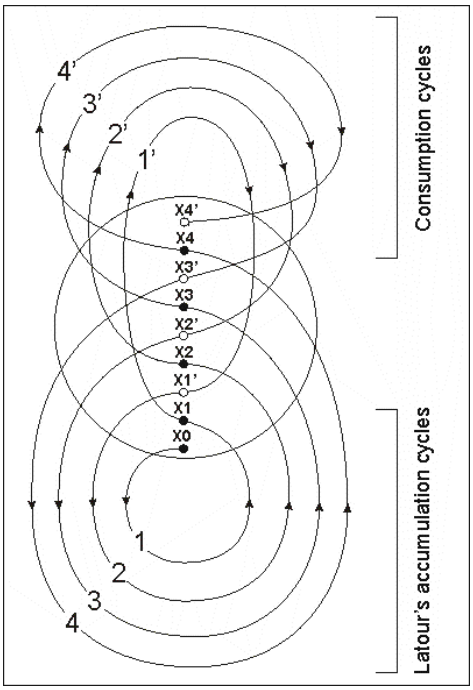


Figure 17. Production-Consumption Model of Edition 4, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

During production cycle 4, the fourth edition was also prepared for consumption cycle 4', during which this edition would be sold. In order to make this edition commercially successful, the following topics were discussed in the front matter: the need to keep up with the changes in science and technology, the description of the revision process, and some of the characteristics of this particular edition, namely, pronunciation as an added feature and comprehensiveness of the dictionary. The fourth edition is then sold and used by the public (consumption cycle 4').

Next, Figure 18 is the production-consumption model of the fifth edition of the dictionary. As in all previous editions, the institution in the center is still the same publisher, but there were several changes in the staff. More information is added to the second edition (production cycle 5), which leads to the fifth edition (X5), so production

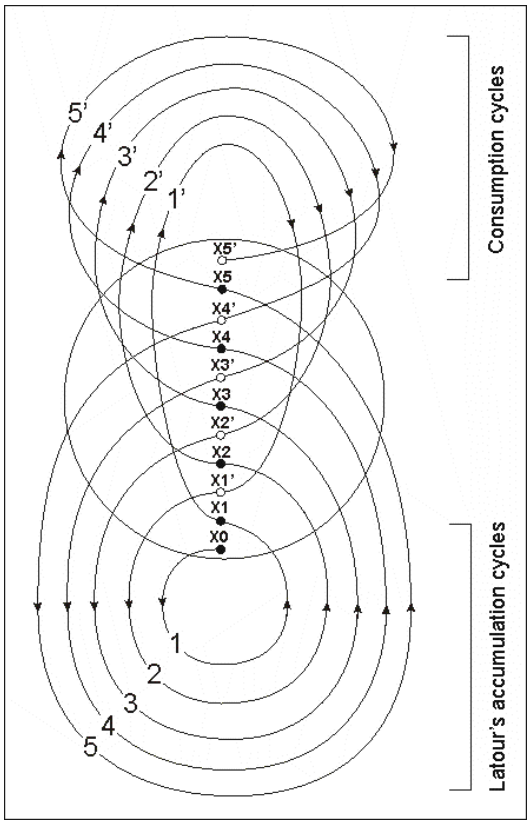


Figure 18. Production-Consumption Model of Edition 5, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

cycle 5 is completed. The types of new information included additional entries from a number of subject fields, completely rewritten definitions, various types of additional information in the articles, altered order of definitions, and altered order of synonyms in the articles.

Also, during production cycle 5, the fifth edition of the dictionary was prepared for consumption cycle 5', during which this edition would be sold. In order to make sure this edition is commercially successful, the editors discussed the following topics in the front matter: the change of audience (the general reader rather than a combination of the general reader and the specialists), the increasing importance of scientific

terminology, the fast pace of research, and the comprehensiveness of this edition. The fifth edition is then sold and used by the public (consumption cycle 5').

Finally, Figure 19 is the production-consumption model of the sixth edition of the dictionary. Again, the institution in the center is still the same publisher, but there were several changes in the staff. More information is added to the fifth edition (production cycle 6), which leads to the sixth edition (X6), so production cycle 6 is completed. The types of new information included additional entries from a number of subject fields, completely rewritten definitions, altered illustrations and illustration descriptions, various types of additional information in the articles, substituted information, and altered order of definitions in the articles.

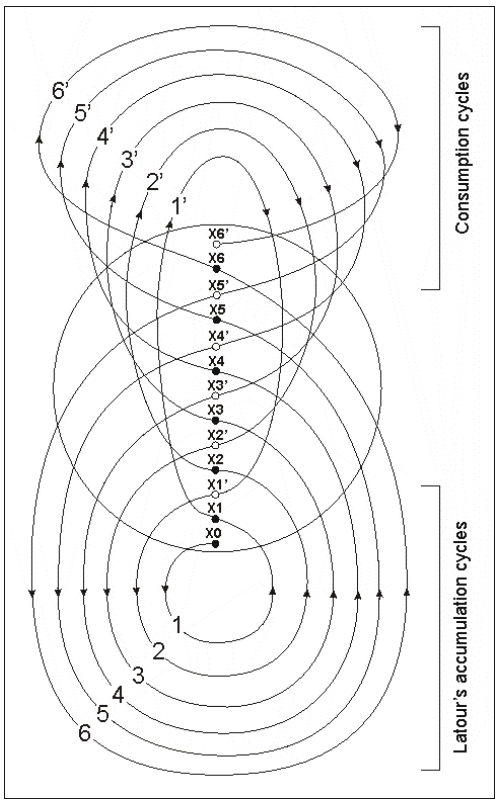


Figure 19. Production-Consumption Model of Edition 6, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

During production cycle 6, the sixth edition of the dictionary was prepared for consumption cycle 6'. In order to make this edition commercially successful, the following topics were discussed in the front matter: the need to keep up with the changes in science and technology, the description of the revision process, and some of the characteristics of this particular edition, namely, its comprehensiveness and status as a standard international reference. Again, the focus is on the development of science and technology and on the status of the dictionary, not on the necessity to form a complete corpus of knowledge. The sixth edition is then sold and used by the public (consumption cycle 6').

As can be seen in Figures 14 through 19, the scientific knowledge economy in which *McGraw-Hill Dictionary of Scientific and Technical Terms* functions can be described as progressive because new knowledge was added as it developed. The center remains the same because only one book is being altered, so no large volumes of information, such as separate volumes or supplements, are added to the dictionary. Even the types of information that are added are almost the same for all editions. As the cultural analysis of the front matters shows, the theme of the development of science and technology rather than getting closer to the complete (finite) volume of scientific knowledge was very common in the twentieth century and in the second half of the twenty-first century. Therefore, instead of getting large volumes of new information at once, the dictionary compilers focused on adding smaller portions of information connected with the developments of science and technology.

Chapter 8: Conclusion

Dictionaries in general and dictionaries of science in particular assign value to knowledge. In addition, dictionaries of science create and stabilize scientific knowledge. However, the cultural work that dictionaries of science perform is usually invisible because these reference works are often viewed as mundane documents. Similarly, dictionaries of science have not been studied much from the cultural studies' point of view even though they are clearly part of our culture and legitimize certain types of knowledge. In this dissertation, I have considered how two dictionaries of science published in English (the first dictionary of science and one of the modern dictionaries of science) participate in the scientific knowledge economy in two different cultural contexts.

The results demonstrate that there was a significant difference in the way the two dictionaries functioned. In the case of *Lexicon Technicum*, which was published in England in the eighteenth century, the main characteristic of the scientific knowledge economy was adding large volumes of information (entire books, for example). I interpret this as an attempt to create a "complete" corpus of knowledge and explain it by the cultural context: as Foucault writes, the table was the center of knowledge in Western culture in the seventeenth and eighteenth centuries (75), so "collecting" all "existing" knowledge and ordering it were the two activities dictionary compilers were clearly interested in.

In the case of *McGraw-Hill Dictionary of Scientific and Technical Terms*, which was published in the United States in the second half of the twentieth century and in the twenty-first century, the scientific knowledge economy in which the dictionary

functioned can be described as progressive: creating each edition became a process that involved adding new knowledge as it developed. I also explain this by the cultural context: in the second half of the twentieth century, the development of science and technology was one of the most common themes, so adding smaller portions of information that was connected with the new developments rather than collecting all "existing" knowledge became more widely spread.

One of the limitations of the study was the fact that my analysis yielded a description of production-consumption models, but it was not a complete cultural analysis. Future research might include a more detailed examination of the persons on the lists of dictionary subscribers. For example, a study of the texts these people subscribed to and such demographic information as the social status, gender, and age of the subscribers would provide a richer cultural context in terms of dictionary consumption. Similarly, a stronger focus on the Royal Society's support for *Lexicon Technicum* would lead to a more complete cultural analysis of the first dictionary of science published in English.

A more complete cultural analysis of *McGraw-Hill Dictionary of Scientific and Technical Terms* might involve considering McGraw-Hill publishing company as an institution. This could lead to a more complete description of how some types of knowledge are legitimated through dictionaries of science while other types of knowledge are eliminated. However, in this case, it would be important not to limit the study within one organization and look at the publishing company's participation in cultural contexts because, as Longo points out, "a study of technical writing as situated in systems of knowledge and power is incomplete if the idea of culture is limited within

one organization" (*Approach* 113).

Another limitation of this study is its focus on only two dictionaries of science in two cultural contexts. Considering a wider variety of dictionaries of science in terms of the subject fields and languages in a larger number of contexts would contribute to our understanding of how dictionaries of science participate in the scientific knowledge economy.

By modifying one of the accepted models that have been used in cultural studies (Latour's model of knowledge accumulation) and combining lexicography and cultural studies, this dissertation advances both of these areas and introduces a new methodology for studying scientific and technical communication. More research on how dictionaries of science function in the scientific knowledge economy is needed because such studies contribute to our general understanding of how knowledge has been made in our society.

Works Cited

Algeo, John. "British and American Biases in English Dictionaries." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.* Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 205-212. Print.

Anderson, Benedict. *Imagined Communities: Reflections on the Origin and Spread of Nationalism.* New York: Verso, 2006. Print.

Andrade, E. N. da C. *A Brief History of the Royal Society.* London: The Royal Society, 1960. Print.

Béjoint, Henri. *The Lexicography of English: From Origins to Present.* New York: Oxford University Press Inc., 2010. Print.

---. *Tradition and Innovation in Modern English Dictionaries.* New York: Oxford University Press Inc., 1994. Print.

Bergenholtz, Henning. "User-oriented Understanding of Descriptive, Proscriptive and Prescriptive Lexicography." *Lexicos* 13 (2003): 65-80. Print.

Bergenholtz, Henning, and Sven Tarp, eds. *Manual of Specialized Lexicography: The Preparation of Specialized Dictionaries.* Amsterdam/Philadelphia: John Benjamins Publishing Company, 1995. Print.

Blyler, Nancy Roundy. "Taking a Political Turn: The Critical Perspective and Research in Professional Communication." *Central Works in Technical Communication.* Eds. Johndan Johnson-Eilola and Stuart A. Selber. New York: Oxford University Press, 2004. 268-280. Print.

Boehlke, Daniel P. "The IBM Personal Computer, Using DOS, Is Introduced." *Great Events from History II: Science and Technology Series.* Ed. Frank N. Magill. Pasadena: Salem Press Inc., 1991. 2169-2173. Print.

Branscomb, Lewis M. "The Metric System in the United States." *Proceedings of the American Philosophical Society* 116.4 (1972): 294-300. Print.

Clark, Gregory. "Ethics in Technical Communication: A Rhetorical Perspective." *IEEE Transactions on Professional Communication* 30 (1987): 190-195. Print.

Cubillo, Mari Carmen Campoy. "Dictionary Use and Dictionary Needs of ESP Students: An Experimental Approach." *International Journal of Lexicography* 15 (2002): 206-228. Print.

DeVries, David Todd, et al. "Medical and Dermatology Dictionaries: An Examination of Unstructured Definitions and a Proposal for the Future." *Journal of the American Academy of Dermatology* 50 (2004): 144-147. Print.

Eco, Umberto. "Metaphor, Dictionary, and Encyclopedia." *New Literary History* 15.2 (1984): 255-271. Print.

---. *Semiotics and the Philosophy of Language*. Bloomington: Indiana University Press, 1986. Print.

Ehrhardt, George R. "Apple II Becomes the First Successful Preassembled Personal Computer." *Great Events from History II: Science and Technology Series.* Ed. Frank N. Magill. Pasadena: Salem Press Inc., 1991. 2073-2077. Print.

Elliott, Clark A. *History of Science in the United States: A Chronology and Research Guide.* New York: Garland Publishing, Inc., 1996. Print.

Ezquerra, Manuel Alvar. "Political Considerations on Spanish Dictionaries." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.* Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 143-152. Print.

Faber, Pamela, et al. "Linking Images and Words: The Description of Specialized Concepts." *International Journal of Lexicography* 20 (2006): 39-65. Print.

Farina, Donna M. T. Cr. "Marrism and Soviet Lexicography." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.* Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 153-170. Print.

Feather, John P. *Book Prospectuses Before 1801 in the John Johnson Collection: A Catalogue with Microfiches.* Oxford: Oxford Microform Publications LTD, 1976. Print.

---. *The Provincial Book Trade in Eighteenth-Century England.* Cambridge: Cambridge University Press, 1985.

Foucault, Michel. *The Archeology of Knowledge.* New York: Pantheon Books, 1972. Print.

---. *The Order of Things: An Archeology of the Human Sciences.* New York: Vintage Books, 1994. Print.

Frawley, William. "In Defense of the Dictionary: A Response to Haiman." *Lingua* 55 (1981): 53-61.

---. "New Forms of Specialized Dictionaries." *International Journal of Lexicography* 1 (1988): 189-213. Print.

"George, Prince of Denmark and Duke of Cumberland (1653-1708)." *Oxford Dictionary of National Biography.* Oxford University Press, 2004. Web. 5 July 2011.

"George III." *Encyclopædia Britannica Online.* Encyclopædia Britannica Inc., 2012. Web. 09 June 2012.

Green, Jonathon. *Chasing the Sun: Dictionary-makers and the Dictionaries They Made.* London: Jonathan Cape, 1996. Print.

Haiman, John. "Dictionaries and Encyclopedias." *Lingua* 50 (1980): 329-57. Print.

---. "Dictionaries and Encyclopedias Again." *Lingua* 56 (1982): 354-355. Print.

Hancher, Michael. "Illustrating Webster." *Dictionaries: Journal of the Dictionary Society of North America* 31 (2010): 1-45. Print.

Harris, John. *Proposals for Printing an Universal English Dictionary of Arts and Sciences, Explaining not Only All the Terms of Arts, but the Arts Themselves, Entitled,* Lexicon Technicum Magnum. London, 1702. Print.

---. "Proposals for Reprinting the First, and for Printing the Second Volume of Dr. Harris's Universal English Dictionary of Arts and Sciences, Explaining not Only All the Terms of Arts, but the Arts Themselves, and Entitled, *Lexicon Technicum.*" *Glossographia Anglicana Nova: Or, a Dictionary, Interpreting Such Hard Words of Whatever Language, as Are at Present Used in the English Tongue, with Their Etymologies, Definitions, & c.* London, 1707. Print.

"Harris, John." *Oxford Dictionary of National Biography.* Oxford University Press, 2009. Web. 17 June 2011.

Harris, Roy. "The History Men." *Times Literary Supplement* 3 Sep. 1982: 935-936. Print.

Hartmann, R. R. K., and Gregory James. *Dictionary of Lexicography.* London/New York: Routledge, 1998. Print.

Herndl, Carl G., and Adela C. Licona. "Shifting Agency: Agency, Kairos, and the Possibilities of Social Action." *Communicative Practices in Workplaces and the Professions: Cultural Perspectives on the Regulation of Discourse and Organizations.* Eds. Mark Zachry and Charlotte Thralls. Amityville: Baywood Publishing Company, 2007. 133-153. Print.

Hoare, Michael Rand. "Scientific and Technical Dictionaries." *The Oxford History of English Lexicography.* Ed. A. P. Cowie. Vol 2. Oxford: Clarendon Press, 2009. 2 vols. 47-93. Print.

Ilson, Robert F. "Lexicographic Archaeology: Comparing Dictionaries of the Same Family." *The History of Lexicography: Papers from the Dictionary Research Centre Seminar at Exeter, March 1986.* Ed. R. R. K. Hartmann. Amsterdam/Philadelphia: John Benjamins Publishing Company, 1986. 127-136. Print.

"International System of Units (SI)." *Encyclopædia Britannica Online.* Encyclopædia Britannica Inc., 2012. Web. 09 June 2012.

Jackson, Howard. *Lexicography: An Introduction.* New York: Routledge, 2002. Print.

Jones, Richard C. "NASA Launches the Hubble Space Telescope." *Great Events from History II: Science and Technology Series.* Ed. Frank N. Magill. Pasadena: Salem Press Inc., 1991. 2377-2381. Print.

Kastman Breuch, Lee-Ann, Andrea M. Olson, and Andrea Breemer Frantz. "Considering Ethical Issues in Technical Communication Research." *Research in Technical Communication.* Eds. Laura J. Gurak, and Mary M. Lay. Westport: Praeger, 2002. 1-22. Print.

Katz, Steven B. "The Ethic of Expediency: Classical Rhetoric, Technology, and the Holocaust." *Central Works in Technical Communication.* Eds. Johndan Johnson-Eilola and Stuart A. Selber. New York: Oxford University Press, 2004. 195-210. Print.

Kernan, Alvin. *Printing Technology, Letters, and Samuel Johnson.* Princeton, New Jersey: Princeton University Press, 1987. Print.

Kim, Chin W. "One Language, Two Ideologies, and Two Dictionaries: The Case of Korean." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.* Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 213-236. Print.

Landau, Sidney I. *Dictionaries: The Art and Craft of Lexicography.* Cambridge: Cambridge University Press, 2001. Print.

Latour, Bruno. *Science in Action: How to Follow Scientists and Engineers through Society.* Cambridge, Massachusetts: Harvard University Press, 1987. Print.

Layton, David. "Diction and Dictionaries in the Diffusion of Scientific Knowledge: An Aspect of the History of the Popularization of Science in Great Britain." *The British Journal for the History of Science* 2 (1965): 221-234. Print.

Leitch, Vincent B. *Cultural Criticism, Literary Theory, Poststructuralism.* New York: Columbia University Press, 1992. Print.

Longo, Bernadette. "An Approach for Applying Cultural Study Theory to Technical Writing Research." *Critical Power Tools: Technical Communication and Cultural Studies.* Eds. Scott, J. Blake, Bernadette Longo, and Katherine V. Wills. Albany: State University of New York Press, 2006. 111-131. Print.

---. *Spurious Coin: A History of Science, Management, and Technical Writing.* Albany: State University of New York Press, 2000. Print.

Malloy, Joseph T. "IBM Introduces a Personal Computer with a Standard Hard Disk Drive." *Great Events from History II: Science and Technology Series.* Ed. Frank N. Magill. Pasadena: Salem Press Inc., 1991. 2240-2244. Print.

---. "The Floppy Disk Is Introduced for Storing Data Used by Computers." *Great Events from History II: Science and Technology Series.* Ed. Frank N. Magill. Pasadena: Salem Press Inc., 1991. 1923-1927. Print.

Marello, Carla. "Florence like Athens and Italian like Greek: An Ideologically Biased Theme in the Forewords of Some Italian Thesauri of the 19th Century." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.* Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 171-180. Print.

McKie, D. "John Harris and His *Lexicon Technicum*." *Endeavor* 14 (1945): 53-57. Print.

Morton, Herbert C. *The Story of* Webster's Third: *Philip Gove's Controversial Dictionary and Its Critics.* New York: Cambridge University Press, 1994. Print.

Nyce, Paul G. "Optical Disks for the Storage of Computer Data Are Introduced." *Great Events from History II: Science and Technology Series.* Ed. Frank N. Magill. Pasadena: Salem Press Inc., 1991. 2262-2266. Print.

Ochoa, George, and Melinda Corey. *The Timeline Book of Science.* New York: The Stonesong Press, Inc., 1995.

---. *The Wilson Chronology of Science and Technology.* New York: The H. W. Wilson Company, 1997. Print.

Olby, Robert. "The Molecular Revolution in Biology." *Companion to the History of Modern Science.* Ed. R. C. Olby, et al. London: Routledge, 1990. 503-520. Print.

Opitz, K. "Special-Purpose Lexicography: Dictionaries for Technical Use." *Lexicography: Principles and Practice.* 1st ed. Ed. R. R. K. Hartmann. London: Academic Press, 1983. 163-180. Print.

Pedersen, Jette. "The Identification and Selection of Collocations in Technical Dictionaries." *Lexicographica* 11 (1995): 60-73. Print.

Slack, Jennifer Daryl, David James Miller, and Jeffrey Doak. "The Technical Communicator as Author: Meaning, Power, Authority." *Critical Power Tools: Technical Communication and Cultural Studies.* Eds. J. Blake Scott, Bernadette Longo, and Katherine V. Wills. Albany: State University of New York Press, 2006. 25-46. Print.

Sprat, Thomas. *The History of the Royal Society of London, for the Improving of Natural Knowledge.* London, 1667. Print.

Sutphen, Charles E. "The Microprocessor *Computer on a Chip* Is Introduced." *Great Events from History II: Science and Technology Series.* Ed. Frank N. Magill. Pasadena: Salem Press Inc., 1991. 1938-1943. Print.

Thralls, Charlotte, and Nancy Roundy Blyler. "The Social Perspective and Professional Communication: Diversity and Directions in Research." *Professional Communication: The Social Perspective.* Eds. Nancy Roundy Blyler, and Charlotte Thralls. Newbury Park: Sage Publications, 1993. 3-34. Print.

Tietge, David J. *Rational Rhetoric: The Role of Science in Popular Discourse.* West Lafayette: Parlor Press, 2008. Print.

Tsohatzidis, Savas L. *Meanings and Prototypes: Studies in Linguistic Categorization.* London: Routledge, 1990. Print.

Whitcut, Janet. "Taking It for Granted: Some Cultural Preconceptions in English Dictionaries." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.* Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 253-257. Print.

Wierzbicka, Anna. "Dictionaries and Ideologies: Three Examples from Eastern Europe." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.* Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 181-196. Print.

Yeo, Richard. *Encyclopedic Visions: Scientific Dictionaries and Enlightenment Culture.* Cambridge: Cambridge University Press, 2001. Print.

Zorg, R. David. "Philippine Regionalism versus Nationalism and the Lexicographer." *Cultures, Ideologies, and the Dictionary: Studies in Honor of Ladislav Zgusta.*

Ed. Braj B. Kachru and Henry Kahane. Tübingen: Niemeyer, 1995. 197-201.

Print.

List of Dictionaries Cited

Harris, John. *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* London, 1704. Print.

---. *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* London, 1708. Print.

---. *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* London, 1710. Print.

---. *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* London, 1716. Print.

---. *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* London, 1723. Print.

---. *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* London, 1725. Print.

---. *Lexicon Technicum: or, an Universal English Dictionary of Arts and Sciences: Explaining Not Only the Terms of Art, but the Arts Themselves.* London, 1736. Print.

McGraw-Hill Dictionary of Scientific and Technical Terms. New York: McGraw-Hill

Book Company, 1974. Print.

McGraw-Hill Dictionary of Scientific and Technical Terms. 2nd ed. New York: McGraw-Hill Book Company, 1978, Print.

McGraw-Hill Dictionary of Scientific and Technical Terms. 3rd ed. New York: McGraw-Hill Book Company, 1984. Print.

McGraw-Hill Dictionary of Scientific and Technical Terms. 4th ed. New York: McGraw-Hill Book Company, 1989. Print.

McGraw-Hill Dictionary of Scientific and Technical Terms. 5th ed. New York: McGraw-Hill Book Company, 1994. Print.

McGraw-Hill Dictionary of Scientific and Technical Terms. 6th ed. New York: McGraw-Hill Book Company, 2003 Print.

Society of Gentlemen. *A Supplement to Dr. Harris's Dictionary of Arts and Sciences.* London, 1744. Print.

Appendices

Appendix A

Tables Describing *Lexicon Technicum*

Table 1. Changes in the Imprints of *Lexicon Technicum* and *A Supplement to Dr. Harris's Dictionary of Arts and Sciences*.

1st ed. Vol. I 1704	**2nd ed. Vol. I 1708**	**1st ed. Vol. II 1710**	**3rd ed. Vol. I 1716**	**2nd ed. Vol. II 1723**	**4th ed. Vol. I 1725**	**5th ed. Vol. I, II. 1736**	***Supplement***
Dan. Brown	Dan. Brown	Dan. Brown	Dan. Browne	D. Brown	D. Browne	D. Brown	-
Tim. Goodwin	Tim. Goodwin	Tim. Goodwin	Tim. Goodwin	-	-	-	-
John Walthoe	John Walthoe	John Walthoe	John Walthoe	J. Walthoe	J. Walthoe	J. Walthoe	-
Tho. Newborough	Tho. Newborough	-	-	-	-	-	-
John Nicholſon	John Nicholſon	John Nicholſon	John Nicholſon	-	-	-	-
Tho. Benskin	-	-	-	-	-	-	-
-	-	-	-	J. Knapton	J. Knapton	Meſſ. Knapton	-
Benj. Tooke	-	Benj. Tooke	Ben. Tooke	B. Tooke	-	-	-
-	-	-	-	S. Tooke	S. Tooke	-	-

Dan. Midwinter	Dan. Midwinter	Dan. Midwinter	Dan. Midwinter	D. Midwinter	D. Midwinter	D. Midwinter	-
Tho. Leigh	-	-	-	-	-	-	-
Francis Coggan	Francis Coggan	-	-	-	-	-	-
-	-	M. Atkins	-	-	-	-	-
-	-	-	-	B. Cowse	B. Cowse	-	-
-	-	T. Ward	Tho. Ward	T. Ward	T. Ward	T. Ward	-
-	-	-	-	E. Symon	E. Symon	E. Symon	-
-	-	-	-	E. Valentine	E. Valentine	-	-
-	-	-	-	J. Clark	J. Clark	J. Clark	Sold by J. Clarke
-	-	-	-	-	B. Motte	B. Motte	-
-	-	-	-	-	-	A. Bettes-worth	-
-	-	-	-	-	-	C. Hitch	-
-	-	-	-	-	-	E. Wicksteed	-

-	-	-	-	-	-	C. Bathurst	Sold by C. Bathurst
-	-	-	-	-	-	A.Ward	-
-	-	-	-	-	-	T. Wotton	-
-	-	-	-	-	-	T. Hatchet	-
-	-	-	-	-	-	E. Comins	-
-	-	-	-	-	-	-	Sold by M. Cooper (the first one ment.)
-	-	-	-	-	-	-	Sold by T. Co...
-	-	-	-	-	-	-	Sold by T. Gardner
-	-	-	-	-	-	-	Sold by most other Book-sellers in Town and Country

Table 2. Changes in the Microstructure of Edition 1, Volume II, *Lexicon Technicum*.

Type of Changes	**Changes**
Change of number and a revised definition in a new field	Vol. I, Ed. 2: BEAMS *of a ship*, are the great main croſs Timbers which hold the Sides of a Ship from falling together, and which alſo ſupport the *Decks* and *Orlops*. The *Main Beam* is next the Main Maſt, and from it they are reckoned by Firſt, Second, or Third Beam. The great Beam of all is called the *Mid/hip Beam*. Vol. II, Ed. 1: BEAM, in any Building, is a Piece of Timber lying acroſ it, and into which the Feet of the principal Rafters are framed. [...]
A revised definition in a new field	Vol. I, Ed. 2: COLLATION, in a Logical Senſe, is the ſame as a comparing of one thing well with another; but now-adays ‘tis uſed for an *Handſome Treat* or *Entertainment*. Vol. II, Ed. 1: COLLATION, is the beſtowing of a Living on a Clerk by an Archbiſhop or Biſhop, when that Living is the Biſhop’s or Archbiſhop’s own Gift: But when the Living is in the Gift of another, the Biſhop is ſaid to give the Clerk *Inſtitution* into it on the Patrons Preſentation, and the Arch-deacon gives him *Induction* into it on the Biſhops Mandate, as well from the Collation as Inſtitution. Vol. I, Ed. 2: COLOUR, may be conſidered two ways, 1. As it a Quality reſiding in the Body that is ſaid to be ſo and ſo colored, or which doth modify the Light after ſuch and ſuch a manner: Or 2. As more properly the Light it ſelf, which ſo modified ſtrikes upon the Organ of Sight, and produces that Senſation which we call *Colour*. [...] Vol. II, Ed. 1: COLOUR, in a Law Senſe, is a Plea that is probable, though in truth falſe; and hath this End, to draw the Trial of the Cauſe from the Jury to the Judge.
A revised definition	Vol. I, Ed. 2: COLD, is one of thoſe Qualities of Bodies which they call *Primary,* and is nothing but the arriving of the minute and inſenſible Parts of any Body at ſuch a State, as that they a more ſlowly or faintly agitated than thoſe of our Fingers or other Organs of Feeling; for from this Effect we pronounce any Body to be cold. [Further the article contains a detailed discussion of the views of the following thinkers: Mr. Hobbs, Gaſſendus, Mr.

	Boyle, Sylivius, and Dr. Slare] Vol. II, Ed. 1: COLD, It hath been obſerv'd by Mr. *Geoffroy* (in a Diſcourſe which he read before the *French* Royal Academy of Sciences, and which is mentioned in *Phil. Tranſ.* N.274) that a Mixture of the greateſt Part of all the ſeveral Kinds of Salts, in many Liquors is accompanied with a *ſenſible degree of Coldneſs*, notwithſtanding the violent Fermentations which ſuch Mixtures do ſometimes produce. [...] Vol. I, Ed. 2: DUCTILITY, is an eaſie yeilding extenſion and ſpreading of the Parts of any Metal under the Hammer, & c. and this is moſt remarkably the Property of Gold, whoſe Ductility is ſo great as to be really wonderful. [...] Vol. II, Ed. 1: DUCTILITY, Captain *Halley*, in *Philoſoph. Tranſ.* N. 194, gives this further Account of the extreme Ductility, and exceeding Minuteneſs of the Patts of Gold. [...] Vol. I, Ed. 2: TRAVERSE, in Fortification, is a little *Trench* bordered with two *Parapets, viz.* One on the right Side, and another on the left, which the Beſiegers make quite thwart the *Moat* of the Place, to paſs ſecure from *Flank*-ſhot, and to bring the Miners to the Baſtions. This *Traverſe* is usually covered on top with *Hurdles* or *Bavins* laden with Earth, for Security from the Fire-works, and differs from a *Coffer* only in this reſpect, That it is made by the *Beſiegers*, and the other by the *Beſieged*. This word is now often us'd for any Retrenchment or Line Fortify'd with Faſcines, Gabions Barrels, Bags of Earth & c. Vol. II, Ed. 1: TRAVERSE, in Fortification, is a Trench with a ſmall Parapet, and ſometimes with two, one on each side; it ſerves as a Cover from the Enemy, when they come on their Flank. Sometimes 'tis covered over with Planks on top, and is also loaded with Earth; they are of good uſe to ſtop an Enemy's way, and to prevent being Enſiladed. It is alſo a good Defence in a dry Ditch, when the Parapet is made on the ſide next the oppoſite Flank. There is alſo a *Traverſe* in a wet Dtich, which is made by throwing into the Foſs or Ditch over againſt the Place where the Miner is to be put to the Foot of the Wall, Sauciſſons, Joyſts, and other pieces of Wood, with Faſcines, Stones, Earth, & c. in order to fill up the Ditch, and to carry a Galiery over it. Alſo a Wall of Stone or

	Earth, built a-croſs a Work which is commanded, in order to cover the Men, is called a *Traverſe*.

Table 3. New Entries in Edition 5, *Lexicon Technicum*.

Subject Fields	**Entries**
No subject field	Animalcula Animated Annuities Astronomical Houſes Astronomicals Basons of a Balance Bason Bastion Plat. Baston/Battoon Bath Cabala Chart or Sea Chart Deprivation of a Benefice Deprivation ab officio Estrade Fountain Horography Nealing of Glass Neap-tides Necrology Necromancy Parallax of Aſcenſion and Deſcenſion Pneumatology Point of Reflection Point of Refraction Point Rectifiable Rectification To Rectify Shadow Stereotomy Stimulation Ultra Mundane
Algebra	Plus
Anatomy	Ala Annular Ligament Crusta Villoſa Ulnaris Extenſor
Architecture	Basis Cabinet Cabled Flutes Masonry

	Masque Point of View Theater
Aſtrology	Airy Triplicity Animodar Mars To Rectify a Nativity
Astronomy	Parallax of Declination
Botany	Annual Leaves Hose-husk Plush Stem Umbellæ
Carpentry	Batement Horse
Chymiſtry	Crystallization Mars
Fortification	Bastion Chausse
Geometry Higher Geometry	Evolvent Evolute
Gunnery	Point Blank
Heraldry	Aisle Anime Chausse Essorant Estoille Fourchee Point Point Inverted Point en Band Pointed Rustre
Law	Aisiamenta Annexation Annoisance Estovers Juris-prudence Petty Treaſon
Levelling	Parallax
Mathematics	Horoscope
Mechanics	Animated Power Mass Pneumatice
Medicine	Evacuation

	Pneumonics
Natural History	Crystal Nautilus
Optics	Point of Diſperſion
Painting	Sgrafit Ultima Basia
Phyſicks	Phænomenon
Rhetoric	Ethopoeia
Sea Language	Petty Tally

Table 4. Entries Deleted in Edition 5, *Lexicon Technicum.*

Subject Fields:	**Entries:**
No subject field	Chart Conjeries Rays
Chymiſtry	Martial Regulus of Antimony
Law, Common, Civil, and Cannon	De quibus sur dissei
History, Ancient Cuſtoms, & c.	Annualia
Navigation and Sea-Terms	Stoaked

Table 5. Changes in the Microstructure of Edition 5, *Lexicon Technicum* (Articles from Edition 4, Volume I).

Type of Changes	**Changes**
A revised definition	A Flat Bastion, Ed. 4 Vol. I: if the Diſtance between the Angles of the Interior Polygon be double the usſual length, then a Baſtion is made in the middle before the Curtain; but it generally hath this diſadvantage, that unleſs there be an extraordinary Breadth allowed to the Moar, the turning Angle of the Counterſcarp runs back too far into the Ditch, and hinders the Sight and Defence of the 2 oppoſite Flanks. Ed. 5: is a Baſtion built in the Middle of a Curtain, when it is too long to be defended by the Baſtion at its Extremes. A Cut Bastion, Ed. 4 Vol. I: is that which makes a Reentering Angle at the Point; and is ſometimes called, Bastion *with a Tenaille*, whoſe Point is cut off, ad makes an Angle inwards, and two Points outwards: This is done when Water, & c. hinders carrying the Baſtion to its full extent, or when it ſhould be too ſharp. Ed. 5: is that which has a Re-entring Angle at the Point; ſometimes alſo called, *Baſtion with a Tenaille*; uſed, when without ſuch a Contrivance the Angle would be too acute. We likewise give the Term *Cut Baſtion* to ſuch a one as is cut off from the Place by ſome Ditch, & c. ſome modern Engineers having found the Art of Fortyfying by Pieces detach'd from the reſt. Theſe are alſo called *Ravelines.* A Deformed Bastion, Ed. 4 Vol. I: is that which wants one of its *Demi-Gorges*, because one side of the Interior Polygon is so very ſhort. Ed. 5: is that which wants one of its Demi-Gorges, one side of the Interior Polygon being too ſhort. A Demi-Bastion, Ed. 4 Vol. I: hath but one Face and Flank, and is uſually before a Horn-work or Crown-work. Ed. 5: hath but one Face and Flank. ... Their chief Uſe is before a Horn-work or Crown-work. Checkey, Ed. 4 Vol. I: the Herald's Term for a Bordure or Ordinary that hath more than two Rows of Checkers; for if it hath only two,

	they call it *Counter-componed*. Ed. 5: [in Heraldry] is one of the moſt noble and moſt ancient figures that are uſed in armory, and a certain author faith, ought to be given to none but valiant warriers, in token of their nobility; for the Cheſs-board repreſents a field of battle, and the pawns and men on both sides, represent the soldiers of two armies, which move, attack, advance, or retire, according to the two Gameſters, that are their generals. See the Figure annexed. The figure is always compoſed of metal and colour; but ſome Authors would have it reckoned among the ſeveral Sorts of Furrs. Points, Ed. 4 Vol. I: *in Heraldry*, are ſeveral Places in an Eſcutcheon, diverſly Named according to their Situation. See the Word Eſcutcheon. Ed. 5: [in *Heraldry*] are the Diviſions of an Eſcutcheon into ſeveral Squares, ſometimes to the Number of 9, and ſometimes to 15, ſome of which are of one Colour or Metal, the others of another; which are alſo call'd the Equipollent Points. An Eſcutcheon is alſo otherwiſe divided into Points which have ſeveral Names and Values, according to their ſeveral Places. ...
Additional information in the definition	Ajutage, is a Spout for a *Jet d'Eau* in any fountain. Mr. *Mariott* affirms, than an even poliſhed round Hole in the End of the Pipe, or Tube, will give n higher Jet than either a Cylindrical or Conical Ajutage; but of thoſe the latter is the beſt: **Here follows ſome Proportions of Ajutages and their Tubes.** **1. If the Heights of two Tubes continually full of Water be unequal, and the Adjutages likewiſe unequal, then the Quantities of Water ſpouting out through them in the ſame Time, are in the Ratio compounded of the ſimple Ration of the Ajutages, and the ſubduplicate Ratio of the Heights...** Solid Bastions, are thoſe that **are filled up entirely, and** have the Earth equal to the Height of the Rampart, without any void Space towards the Centre. **A** Deformed **or Irregular** Bastion A Demi-Bastion, hath but one Face and Flank. **To fortify the Angle of a Place that is too acute, they cut the Point, and place two Demi-Baſtions, which make a *Tenaille*, or a Re-entering Angle.** ...

	Charter-Party, is an Indenture of Covenants and Agreements made between Merchants, or between Owners of Ships and the Maſters and Seafaring Men, touching their Affairs, or Commanders. **It is properly a Deed or Policy whereby the Maſter or Owner of the Veſſel engages to furniſh immediately a tight ſound Ship, well equipp'd, caulk'd, and ſtopped, provided with Anchors, Sails, Cordage, and all other Furniture, to perform the Voyage required; as, Equipage, Hands, Victuals, and other Neceſſaries, for a certain Sum to be paid by the Merchant for the Freight.** Conoid, is a Solid **Body reſembling a Cone, except in this, that inſtead of a perfect Circle for its Baſe, it has an Ellipſis, or ſome other Curve approaching thereto,** produced by the Circumvolution of any Section of the Cone about its Ax ... Jurisdiction, Is a Dignity which a Man has conferr'd on him to do Juſtice in Caſes of Complaint **made before him. Of this there are two Kinds; one, which a Man hath by reaſon of his *Fee,* of doing Right in al Plaints relating to his *Fee,* by Vertue thereof. The other is collated by a Prince to a *Bailiff*; which in a large Senſe may ſignify all ſuch as have Commiſſion from the Prince to give Judgment in any Caſe.**
Additional etymological information	Aistheterium **[Gr. to perceive]** Anodynes **[Gr. *Pain*]** Asymmetry **[of a *priv.*, Gr.]** Basilioglossum **[of *a Foundation,* and *Gr. the Tongue*]** Bathmis **[*Gr., a Step*]** Batrachus **[*Gr. a Frog*]** Battaile ***F.*** Caballine **[of *Caballinus, L.*]** Cachecticus **[*Gr.*]** Cachexy **[*Gr. Habit*]**

	Cacochymy **[*Gr. Juice*]** Cacoethes **[*Manner* or *Cuſtom, Gr.*]** Cæcum ***L.*** Cæcarean Section ... **ſo called of *Julius Cæſar*, who was after that manner brought into the World.** Caisson **F.** Calcaneus **L.** Calcination **L.** Congruity **[*Congruitas, L.*]** Conjunctiva ***L.*** Conjunction ***L.*** Conniventes ***L.*** Connoid **[*Gr.* Form]** Crus ***L.*** Crustaceous **[*Cruſtaceous, L.*]** Crustula ***L.*** Crymodes **[*Gr.*]** Cryptorchis [**to hide, and *Gr.* a Teſticle**] Depressor, *vel Deprimens Auricularum* ***L.*** Depressor, *Labii Inferioris* ***L.*** Depressor, *Labiorum* ***L.*** Depressor, *Oculi* ***L.*** Deprimens, *Humilis* ***L.***

	Elminthes **[Gr.]** Elodes **[Gr.]** Elythroides **[a Sheath, and Gr. Shape]** Ethicks **[manner, & c. Gr.]** Ethmoides **[Gr.]** Etymology **[true and a Word]** Evanid **[Evanidus, L.]** Euchymia **[Gr. q.d. good Juice]** Eucrasia **[Gr.]** Euexia **[Gr.]** Horologiography **[Gr. to deſcribe]** Horometry **[an hour and Gr. to meaſure]** Horoscope **[Gr. to view]** Horrifica ***L.*** Hors *de ſon ſee* ***F.*** Phacos **[Gr.]** Phagadæna **[Gr.]** Phalacrosis **[Gr.]** Phalangosis **[Gr.]** Phantasy **[Gr.]** Pharmaceutic **[Gr. *to prepare*]** Pharmacopoea **[Gr. *to make*]**

	Pharmacum **[Gr.]** Pneumatocele **[Gr. *Wind* and Gr. *a Rupture*]** Pneumatomphalis **[Gr. *the Navel*]** Pneumatosis **[Gr.]** Stenography **[*Covert* or *Private,* and *Gr. Writing*]** Stentorophonick-*Tube* **(ſo called of *Stentor,* mentioned by *Homer*)** Stereobata **[Gr. *to aſcend firmly*]** Stereography **[*ſolid,* and *Gr. Deſcription*]** Stereometry **[*Gr. to measure*]** Sternohyoides **[*the Breaſt Gr.*]** Sternothyroeides **[*Gr.*]** Tetanus **[*Gr.*]** Tetrachord **[*Gr.*]** Tetragonias **[*Gr.*]** Tetrahedron **[*Gr.*]** Tetrapetalous **[*four,* and *Gr. a Flower Leaf*]** Tetrapharmacum **[*Gr.*]** Tetraptotes **[*Gr. a Cafe*]** Tetrastyle **[*Gr. a Column*]**
An additional illustration	Points [in *Heraldry*]
An additional reference to another article	A Deformed or Irregular Bastion ... **See *Gorge.***
Alternate spelling	Cabosed, **Caboched**
Reference to	Petit *Treason,*

another article instead of definition	Ed. 4 Vol. I: in Common Law, is when a Servant kills his Maſter, a Wife her Husband, a Secular or Religious Man, his Prelate or Superior, to whom he owes Faith and Obedience: In how many other Caſes it may be committed, ſee *Cromp. Juſt, of Peace*. Ed. 5: See *Petty.*
A reference to another article deleted	A Demi-Bastion, Their chief Uſe is before a Horn-work or Crown-work. (This is alſo called an *Epaulment*. -del.)

Table 6. Changes in the Microstructure of Edition 5, *Lexicon Technicum* (Articles from Edition 4, Volume II).

Type of Changes	**Changes**
A revised definition	Animal *Secretion*, Ed. 2 Vol. II: is that Action in an Animal Body, whereby by means of the Glands all proper Separations of Particles, proper to be Secerned or Separated from the Blood, are made, throughout its whole Courſe of Circulation. How these *Secretions* are every where made in the Body, 'tis of very great Uſe to understand; and ſome of our Modern Phyſicians who have apply'd themſelves to conſider the wonderful Machine of a Human Body Geometrically and Mechanically, have made great Advances this way; ſuch as *Borelli, Bellini, Baglivi, Pitcairne, Cheyne, Wainwright*, & c. from whom you have the following Account of this Important Affair. ... Ed. 5: is that Separation of Juices from one another, as is performed by the Glands; and tho' it is of the greateſt Importance to be well understood, of any one Branch of Phyſical Knowledge, yet it has not been talk'd of by any in an intelligible Manner, until some Authors, by the Aſſiſtance of Geometrical Reasoning, have demonſtrated the Laws of Circulation in an anomal Machine; the Sum of which may be conceived under theſe three Heads. ... Annuity, Ed. 2 Vol. II: For the Recovery of an Annuity no Action lies, but only a *Writ of Annuity* againſt the *Grantor*, his Heir, or Succeſſors. Ed. 5: Dr. *Halley*, on the *Breſlaw* Bills of Mortality, ſews, that it is 80 to 1, that a Perſon of Five Years of Age does not die in a Year; that it is five and one half to one, that a Man of Forty Years lives Seven Years; and that one of Thirty may reaſonably expect to live Twenty ſeven or Twenty eight Years. So great the Difference there is between the Life of Man of different Ages, that it is an Hundred to one, if one of Twenty lives out a Year; and but Thirty eight to One, that one of Fifty does so. Whence, and from ſome other Obſervations, he has conſtructed the following Table, ſhewing the Value of Annuities from every Fifth Year of Life to the Seventieth.
Additional information in the definition	Animal *Secretion*, ... *Prop. 16*. Such Glands whoſe compounding Arteries are moſt complicated, ſecern the moſt viſcid Matter from the Blood. ***Demonstration.* Let there be a branched Canal of the annexed**

	Figure, and let the Extremity of one of the Branches *c* be ſhut up, and the other branch *b* be open; then by an Engine force through the Trunk *a* any Kind of Viſcid Liquor, ſuch as the Blood; or whoſe compounding Parts are ſome more and ſome leſs fluxile, and it equally run into both the Branches till the Branch *c* be full; but after that, what ſhould move through *c*, muſt paſs through *b*; ſo that the whole Liquor that paſses through the Trunk *a*, muſt likewiſe in the ſame Time paſs through the Branch *b*; now *b* being much ſtraiter than *a*, the Liquor muſt paſs with greater Celerity through *b* than *a*, ſo that as ſuch Parts of the Liquor as are moſt eaſily moved, will firſt paſs the Branch *b*; and the Parts that are leaſt ſuſceptible of Motion, or, in other Words, thoſe which are moſt viſcid, will be ſolliciting their Entrance into the Branch *c*; but this viſcid Matter cannot enter without forcing ſome of the moſt movable or fluid Part of what is contained in *c* into *b*; ſo that *c* will constantly fill with viſcid Matter till it can hold no more: If therefore the Extremity of the Branch of any Artery be totally obſtructed, it is hereby diſpoſed to fill with the moſt viſcis Matter the Blood can ſupply, and that for this Reaſon, *viz*. ... *Prop. 17.* The Quantity of fluid Matter ſeparated in any Gland, is in compound Proportion of the Quantity of Blood, its Celerity at the Oriſices of the excretory Veſſels, the Wideneſs of the Orifices of the Veſſels directly, and the Viſcidity of the Blood reciprocally. ***Demonstration.* The Celerity of the Blood's Motion, the Wideneſs of the Orifices, and the Viſcidity of the Blood, being given, the Quantity ſeparated muſt be as the Quantity of Blood directly; for a greater Quantity ſeparates more, and a leſs Quantity ſeparates less. The QUantity of Blood, its Viſcidity, and the Wideneſs of the Orifices, being given, the Quantity ſeparated will be directly as the Celerity; for a greater Celerity gives a greater Quantity, and a leſs Celerity a leſs. The Quantity of Blood, its Celerity and Viſcidity being given, the Quantity ſeparated will be directly as the Wideneſs of the Orifices; for the wider the Orifices, the more will be separated, and the ſtraiter the leſs. The Quantity and Celerity of the Blood, and the Wideneſs of the Orifices being given, the Quantity ſeparated will be as the Quantity of Blood.** *Prop. 18.* An increaſed Quantity of Blood increaſes the fluid Secretions in a Proportions greater than the viſcid. ***Demonstration.* The Quantity of Blood being increaſed, the Diameter of all the Veſſels will be enlarged, but in different**

	Proportions; for the ſame Force in an increaſed Quantity of Blood applied to the leſs complicated Arteries, will diſtend them, or enlarge their Diameters more than it will the more complicate, because the Reſiſtance in there is greater than in thoſe, and that in Proportion to the Number of Plications, one Artery has more than another. ... *Prop. 20.* An increaſed Celerity of the Blood's Motion, increaſes the fluid Secretions more than the viſcid; and, *vice verſa*, **a decreaſed Celerity leſſens the fluid Secretions more than the viſcid.** ***Demonstration.* The Celerity of the Blood's Motion being greater, the Impetus by which the Arteries are diſtracted, or their Diameters enlarged, will be greater, and ſo exert its Force more upon the less complicated Arteries than upon such as are more complicated, and conſequently promote the fluid more than the viſcid Secretions; and because the increaſed Celerity will, by breaking the Bloodinto ſmall Parts, render it more fluxile, and thereby ſupply a greater Quantity of ſuch Particles as will paſs the GLands, whoſe Diameters are the leaſt; therefore upon this Account alſo, an increaſed Celerity of the Blood's Motion will icnreaſe the fluid Secretions more than the viſcid.** *Prop. 21.* An univerſal enlargement of the Orifices of all the Glands, increaſes the fluid Secretions **more than the viſcid**; and, *vice verſa*, an univerſal Contraction leſſens the fluid Secretions more than the viſcid. ***Demonstration.* The Diameters of the ſmalleſt Orifices being enlarged, are big enough to ſecern the viſcid as well as the fluid Matter; and because the Matter ſecerned in different Glands differ only in Degree of Coheſion and Fluidity (by the firſt *Corol.* of the thirteenth Propoſition) therefore the Orifices of the ſmall Glands being enlarged, more viſcid Matter than uſed to be ſeparated in other Glands, will be ſeparated in theſe; and therefore leſs will be ſeparated in theſe; and therefore leſs will be ſeparated in thoſe Glands that are fitted for viſcid Secretions, and more in thoſe fitted for the fluid. Therefore an univerſal Enlargement of the Orifices of all the Glands, increaſes the fluid Secretions more than the viſcid.** *Prop. 22.* An increaſed Viſcidity of the Blood decreaſeth the fluid Secretions more than the viſcid; and, *vice verſa*, an increaſed Fluidity increaſeth the fluid Secretions more than the viſcid. ***Demonstration.* A decreaſed Celerity of the Blood's Motion leſſens the fluid Secretions more than the viſcid, (by the 20th**

	Propoſition;) but the Celerity decreaſeth as the Reſiſtance increaſeth; now the Reſiſtance is greateſt when the Blood is moſt fluid, because it paſſeth with greateſt Difficulty through the capillary Arteries; therefore an increaſed Viſcidity, by leſſening the Celerity, decreaſeth the fluid Secretions more than the viſcid.
Additional etymological information	Congeneres *Muſculi* ***L.*** Tetragonistick **[*Gr.*]**
An additional illustration	Animal *Secretion* Annuity

Table 7. Entries Common to Edition 5, *Lexicon Technicum* and *A Supplement to Dr. Harris's Dictionary of Arts and Sciences*.

Visual Markings Signaling Novelty:	**Entries:**
☞ (a term present in Harris's dictionary)	Calcination Charter-party Chauntry Ethics
* (a new term)	Basilica Theatre
No signal	Annals Annates Astronomy Basilicæ Bath Charles's-Wain Conjunctions Dysentery Etymology Hospitalers Thane

Appendix B

Tables Describing *McGraw-Hill Dictionary of Scientific and Technical Terms*

Table 8. Contributing Editors, Edition 1, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Title	**Name**	**Position**	**Organization**	**Field**
Prof.	Theodore Baumeister	Consulting Engineer; Stevens Professor of Mechanical Engineering, Emeritus	Columbia University	Mechanical Power Engineering
	Robert L. Davidson	Editor	"Chemical Engineering"	Chemical Engineering; Chemistry; Petroleum Engineering
	Philip B. Jordain	Senior Research Officer	First National City Bank of New York	Computers
	John Markus	Author and Consultant		Electronics
Dr.	Nathaniel Martin		Department of Mathematics, University of Virginia	Mathematics
Dr.	John Quick		Arthur D. Little, Inc., Cambridge, MA	Armaments: Graphic Arts
Dr.	Aaron Strauss		Department of Mathematics, University of Maryland	Mathematics

Table 9. Contributing Editors and Library Consultants, Edition 1, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Title	**Name**	**Position**	**Organization**	**Field/Role in the Dictionary**
Prof.	Theodore Baumeister	Consulting Engineer; Stevens Professor of Mechanical Engineering, Emeritus	Columbia University	Mechanical Power Engineering
	Waldo G. Bowman	Consulting Engineer	Black and Veatch, New York, NY	Civil Engineering
Dr.	John M. Carroll	Associate Professor of Computer Science	University of Western Ontario	Radio Communications
	William R. Corliss	Technical Consultant		Aeronautical Engineering
Dr.	Richard B. Couch	Naval Architecture Research Office	University of Michigan	Naval Architecture
Dr.	Charles B. Curtin	Associate Professor of Biology	Creighton University	Biology
Prof.	Roland H. Good, Jr.	Head, Department of Physics	Pennsylvania State University	Physics
Dr.	H. S. Gutowsky		School of Chemical Sciences, University of Illinois	Physical Chemistry
Dr.	J. Allen Hynek	Director, Department of Astronomy	Northwestern University	Astronomy
	Philip B. Jordain	Senior Research Officer	First National City Bank of New York	Computers
	Alvin W. Knoerr	Formerly, Editor	"Engineering and Mining	Mining Engineering

			Journal"	
	John Markus	Author and Consultant		Electronics
Dr.	Nathaniel Martin		Department of Mathematics, University of Virginia	Mathematics
Dr.	Edward C. Monahan		Department of Atmospheric and Oceanic Science	Oceanography
Dr.	N. Karle Mottet	Professor of Pathology and Director of Hospital Pathology	University of Washington	Biochemistry; Medicine; Psychology
Dr.	Charles Oviatt		State Department of Education of Missouri	Chemistry
Dr.	Guido Pontecorvo		Imperial Cancer Research Fund, London	Genetics and Evolution
Dr.	John Quick		Arthur D. Little, Inc., Cambridge, MA	Armaments: Graphic Arts
Brig. Gen.	Peter C. Sandretto	Formerly, Director, Engineering Management	International Telephone and Telegraph Corporation	Navigation
Prof.	Frederick Schwab		Department of Geology, Washington and Lee University	Geology; Physical Geography
Dr.	Raymond Siever		Department of Geological Sciences, Harvard University	Geology; Physical Geography
Dr.	W. R. Sistrom		Department of Biology,	Microbiology

			University of Oregon	
Dr.	Leonard Spero		Walter Reed Hospital Unit, Fort Dietrick	MD. Chemistry
Dr.	C. N. Touart	Senior Scientist	Air Force Cambridge Research Laboratory	Geochemistry; Geophysics; Meteorology
Prof.	H. H. Uhlig		Department of Metallurgy and Materials Science, Massachusetts Institute of Technology	Metallurgical Engineering
Dr.	Joachim Weindling	Professor of System Engineering and Operations Research	Polytechnic Institute of Brooklyn	Industrial and Production Engineering
Prof.	George S. Bonn		Graduate School of Library Science, University of Illinois	Library Consultant

Table 10. New Contributing Editors, Edition 2, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Title	**Name**	**Position**	**Organization**
Mr.	Gerald M. Eisenberg	Senior Engineering Administrator	American Society of Mechanical Engineers
Dr.	Samuel J. Hessel		Department of Radiology, Peter Bent Brigham Hospital, Harvard Medical School

Table 11. New Consulting Editors and New Library Consultants, Edition 2, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Title	**Name**	**Position**	**Organization**	**Field/Role in the Dictionary**
Prof.	Eugene A. Avallone		Department of Mechanical Engineering, City University of New York	Mechanical Power Engineering
Dr.	Patrick Barry	Senior Staff Scientist	Grumman Aerospace Corporation, Bethpage, NY	Control Systems
Dr.	John F. Clark	Director, Space Application and Technology	RCA Laboratories, Princeton, NJ	Space Technology
	Robert L. Davidson	Editor in Chief	Business Books & Services, Professional & Reference Book Division, McGraw-Hill Book Company	Chemical Engineering; Chemistry; Petroleum Engineering
Dr.	Gary Judd	Professor of Materials Engineering and Vice Provost for Plans and Resources	Rensselaer Polytechnic Institute	Metallurgical Engineering
Dr.	Alan Saleski		Department of Mathematics, Loyola University of Chicago	Mathematics

Table 12. New Entries in Edition 2, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields	**Entries**
No subject field	active amyl alcohol antiprincipal planes antiprincipal point bind-seize binomial expansion bulk storage caproaldehyde caprylyl acetate cellulose methyl ether chloralosane community antenna television covers coversine cpbs cpe cpmc 4-diallylamino-3,5-xylyl-n-methylcarbamate n,n-diallyl-2-chloroacetamide diallyl sulfide ecl epn 1,2-epoxybutane fourré Gal galactaric acid galactitol Galaxy homogeneous transformation homographic transformations ortho-homosalicylic acid 4-homosulfanilamide hymexazol kasugamycin hydrochloride kasumin leucaenine leucaenol leucenine leucenol leucochalcite Lyot filter

	Manila maguey meglumine microemulsion flooding molding time molecular asymmetry molecular exclusion chromatography mycoin c_3 nuclear resonance magnetometer nuclear spallation paroxypropione podophyllinic acid lactone podophyllum resin P pulse *s*-propyl butylethylthiocarbamate propyl cyanide *s*-propyldipropylthiocarbamate propylene glycol methyl ether propyl *para*-hydroxybenzoate propylpiperidine ramps Ramsden disk Reychler's acid Rh selenium disulfide spontaneous combustion step-by-step operation sxaps symclosene thioallyl ether thiocarbamide TOS total order total relief unitary space
ACOUS acoustics	bulk acoustic wave megaphone
ADP automatic data processing	bulk memory declarative macroinstruction decollator direct instruction flat file overwrite random-access memory split-word operation symbolic assembly language listing

	symbolic assembly system symbolic debugging total transfer union catalog
AGR agriculture	leren
ARCH architecture	flat roof
ASTRON astronomy	amphitrite antitail galactic concentration galactic light Giacobinids Greek group inclination of axis Lyra Lysithea open chain RE galaxy RGU system selenofault selenographic coordinates selenographic latitude selenographic longitude Stephan's Quintet totality
ATOM PHYS atomic physics	antiprotonic atom kaonic atom
BIOCHEM biochemistry	exonuclease ferrochelatase flavanol galactokinase lysyl oxidase
BUILD building construction	common wall vent stack vergeboard
CHEM chemistry	baryta water
CHEM ENG chemical engineering	microencapsulation
COMMUN communications	communication bus four-phase modulation
CONT SYS control systems	integral square error
CYTOL	microfilament

cytology	
DES ENG design engineering	flat crank integral-type flange stepped cone pulley telescoping gage
ELEC electricity	flat cable flat-conductor cable four-pole double-throw load-break switch load curve megohmmeter open-circuit voltage overvoltage crowbar uninterruptable power system
ELECTR electronics	active device active filter active logic avalanche-induced migration avalanche oscillator avalanche photodiode avalanche transistor bulk-acoustic-wave delay line bulk diode bulk effect bulk-effect device bulk resistor common mode common-mode error common-mode voltage dial pulse interpreter electronic tuning electronic video recording four-layer device getter sputtering Hall-effect switch Hall voltage integrated-circuit capacitor integrated-circuit resistor integrated injection logic microchannel plate microcomputer microcontroller neutral temperature point-contact diode quarternary phase-shift keying

	scanning radio step change step-function generator
ELECTROMAG electromagnetism	common impedance coupling
ENG engineering	aspirating burner cover plate deckle rod direct extrusion direct-imaging mass analyzer echo-ranging sonar electronic thermometer flat-flamed burner Fourier analyzer Hall-effect gaussmeter loaded wheel mold base molding cycle molding pressure molding shrinkage neutral atmosphere parison parison swell proportioning probe ram travel reversible transit circle step block total air touch feedback water gage
FL MECH fluid mechanics	draft differential total vorticity
GRAPHICS graphics	microfilm plotter
INORG CHEM inorganic chemistry	triuranium octoxide
MATER materials	asphalt shingle flat grain greenheart loaded concrete molding power quarter-sawed refractory sand
MATH mathematics	closed intervals coversed sine

MECH ENG mechanical engineering	air starting valve available draft booster fan closed fireroom system closed nozzle diagonal stay draft loss intake valve lance door opening pressure overspeed governor oversquare engine refractory-lined firebox boiler slabbing cutter water column
MED medicine	echoencephalograph echouterograph flatulence homolateral
MET metallurgy	antislip metal ferrite number flat die forging mold shift selective plating slack quenching step brazing
MICROBIO microbiology	Chlamydiales cowdria Halobacteriaceae kasugamycin Lamprocystis Lampropedia Megasphaera Microcyclus Microellobosporia Selenomonas Symbiotes Thiobacterium Thiocapsa Thiocystis Thiodendron Thiodictyon
MIN ENG mining engineering	inby ramp mining
MINERAL	barytocalcite

mineralogy	basaluminite boothite ferrimolybdite ishikawaite troegerite
MYCOL mycology	homokaryon homokaryosis
NAV navigation	integrated communications-navigation-identification scalloping touch-down dispersion
NUCLEO nucleonics	electron-positron storage ring nuclear yield proportional region
OPTICS optics	point characteristic function
ORD ordnance	active chaff Lance
ORG CHEM organic chemistry	amphiphatic molecule chloflurecol methyl ester chloralose α-chloralose chloranilic acid chlorbenside chlorbromuron chlordimeform chlorfenethol chlorfenpropmethyl chlorfensulfide chlorfenvinphos dialifor diallyl phthalate halocarbon hymecromone isoactyl thioglycolate isoamyl bromide isobornyl acetate isobornyl thiocyanoacetate karbutilate ovex parinol propylene glycol alginate propylene glycol monomethyl ether propylene glycol monoricinoleate propyleneimine

	propyl formate *n*-propyl furoate propyl gallate propyliodone *n*-propyl mercaptan *n*-propyl nitrate propylparaben 1-propylphosphoric acid propylthiopyrophosphate thioacetamide thiocarbanilide 2-(thiocyanomethylthio)benzothiazole tromethamine
PARTIC PHYS particle physics	antiquark neutral current interaction
PETRO ENG petroleum engineering	water-drive reservoir
PHARM pharmacology	aspidospermine chlorcyclizine hydrochloride lysosomotropic drug podophyllin podophyllotoxin propylhexedrine propylthiouracil selenium sulfide thiocresol vermifuge
PHYS physics	exoelectrons neutral beam Ramsey fringes
PHYS CHEM physical chemistry	direct effect rotational level rotational quantum number
SOLID STATE solid-state physics	active substrate bulk lifetime homopolar crystal molecular beam epitaxy
THERMO thermodynamics	isobaric process

Table 13. Entries Deleted in Edition 2, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields:	**Entries:**
No subject field	community antenna television system flat coaxial transmission line leucohalcite Touch-Tone trochotron
CHEM chemistry	hygroscopicity
COMMUN communications	Picturephone Teletype code
ELEC electricity	Megger
ENG engineering	air vent
IMMUNOL immunology	booster dose
MATH mathematics	covering
MICROBIO microbiology	Ferrobacillus
MIN ENG mining engineering	G.H.H. cappel
NAV navigation	air-traffic control clearance
ORD ordnance	antipersonnel agent antipersonnel bomb antiship missile flat trajectory fire flat trajectory weapon
PHARM pharmacology	antirickettsial agent

Table 14. Changes in the Microstructure of Edition 2, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Type of Changes	**Changes**
A revised definition and a revised subject field	Biochronology Ed.1: [PALEON] The study of the fauna and flora of specific geologic time ranges. Ed. 2: [GEOL] The relative age dating of rock units based on their fossil content.
A revised definition	air spring [MECH ENG] Ed.1: A spring in which a control valve discharges compressed air from a reservoir into a bellows when the load is increased and discharges the air from the bellows when the load is decreased. Ed. 2: A spring in which the energy storage element is air confined in a container that includes an elastomeric bellows or diaphragm. air trap Ed.1: [CIV ENG] A device that prevents the escape of foul air or gas from such systems as drains and sewers. Ed.2: [CIV ENG] A U-shaped pipe filled with water that prevents the escape of foul air or gas from such systems as drains and sewers. Chlamydobacteriaceae Ed. 1: [MICROBIO] A family of gram-negative bacteria in the order Chlamydobacteriales possessing trichomes in which false branching may occur. Ed. 2: [MICROBIO] The single family of the order Chlamydiales; characterized by a developmental cycle from a small elementary body to a larger initial body which divides, with daughter cells becoming elementary bodies. Coxiella Ed. 1: [MICROBIO] A genus of small, gram-negative , rod-shaped or coccoid intracellular parasitic bacteria in the family Rickettsieae; include the etiological agent of Q fever. Ed. 2: [MICROBIO] A genus of the tribe Rickettsieae; short rods which grow preferentially in host cell vacuoles. exocytosis Ed. 1: [CYTOL] Discharge of the contents of old lysosomes or digestive vacuoles into the surrounding environment;

	characteristic of cells in lower organisms. Ed. 2: [CYTOL] The extrusion of material from a cell. Flavobacterium Ed. 1: [MICROBIO] A genus of gram-negative, rod-shaped. motile bacteria in the family Achromobbacteraceae that characteristically produce yellow, orange, or red pigmentation. Ed. 2: [MICROBIO] A genus of bacterium of uncertain affiliation; gram-negative coccobacilli or slender rods producing pigmented (yellow, red, orange, or brown) growth on solid media. four-quadrant multiplier Ed. 1: [ADP] The multiplier of an analog computer in which operation is unrestricted as to the sign of the input variables. Ed. 2: [ADP] A multiplier in an analog computer in which both the reference signal and the number represented by the input may be bipolar, and the multiplication rules for algebraic sign are obeyed. Also known as quarter-square multiplier. Green's theorem Ed. 1: [MATH] Determines when the integral along a line of the sum of functions P(x,y) and Q(x,y) is equal to a surface integral of the partial derivatives of P and Q. Ed. 2: [MATH] Under certain general conditions, an integral along a closed curve C involving the sum of functions P(x,y) and Q(x,y) is equal to a surface integral, over the region D enclosed by C, of the partial derivatived of P and Q, namely $$\int_C Pdx + Qdy = \iint_D \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial x}\right) dxdy$$ Micrococcaceae Ed. 1: [MICROBIO] A family of spherical, gram-positive bacteria in the order Eubacteriales characterized by chemoorganotrophic energy metabolism. Ed. 2: [MICROBIO] A family of gram-positive cocci; chemoorganotrophic organisms with respiratory or fermentative metabolism. Micrococcus Ed. 1: [MICROBIO] A genus of bacteria of the family Micrococcaceae; cells are arranged in irregular masses, metabolism is oxidative, and some species form red, yellow, or orange pigments.

	Ed. 2: [MICROBIO] A genus of bacteria in the family Micrococcaceae; cells may occur singly or in pairs, but usually in irregular masses, tetrads, or cubical packets; metabolism is respiratory. mycelium Ed. 1: [MYCOL] A mass of fungal filaments (hyphae) which may be septate and compose the vegetative body of a fungus. Ed. 2: [BIO] A mass of filaments, or hyphae, composing the vegetative body of many fungi and some bacteria. Mycobacteriaceae Ed. 1: [MICROBIO] A family of nonsporeforming, nonmotile, aerobic gram-positive bacteria belonging to the order Acinomycetales. Ed. 2: [MICROBIO] A family of bacteria in the order Actinomycetales; acid-fast, aerobic rods form a filamentous or myceliumlike growth. Mycobacterium Ed. 1: [MICROBIO] A genus of acid-fast, rod-shaped bacteria int he family Mycobacteriaceae. Ed. 2: [MICROBIO] The single genus of the family Mycobacteriaceae; species cause tuberculosis, leprosy, and other chronic granulomas. Mycoplasmataceae Ed. 1: [MICROBIO] The single family of the Mycoplasmatales. Ed. 2: [MICROBIO] A family of the order Mycoplasmatales; distinguished by sterol requirement for growth. Mycoplasmatales Ed. 1: [MICROBIO] An order of the class Mollicutes; organisms are gram-negative, generally nonmotile, nonsporing bacteria which lack a true cell wall. Ed. 2: [MICROBIO] The single order of the class Mollicutes; organisms are gram-negative, generally nonmotile, nonsporing bacteria which lack a true cell wall. Parseval’s equation [MATH] Ed. 1: Parseval equation [MATH] The general case when Bessel’s inequality actually is an equality. Ed. 2: The equation which states that the square of the length of a vector in an inner product space is equal to the sum of the squares of the inner products of the vector with each member of

	a complete orthonormal base for the space. proportional-plus-derivative control [CONT SYS] Ed. 1: Control in which the control signal is proportional to the sum of the error signal and its derivative. Ed. 2: Control in which the control signal is a linear combination of the error signal and its derivative. proportional-plus-integral control [CONT SYS] Ed. 1: Control in which the control signal is proportional to the sum of the error signal, its integral, and its integral. Ed. 2: Control in which the control signal is a linear combination of the error signal, its integral, and its integral. proportional-plus-integral-plus-derivative control [CONT SYS] Ed. 1: Control in which the control signal is proportional to the sum of the error signal and its derivative. Ed. 2: Control in which the control signal is a linear combination of the error signal and its derivative. random access [ADP] Ed. 1: A data-storage device having the property that the time required to access (read or write) a randomly selected datum does not depend on the time of the last access or the location of the most recently accessed datum. Also known as random-access storage; random storage. Ed. 2: 1. The ability to read or write information anywhere within a storage device in an amount of time that is constant regardless of the location of the information accessed and of the location of the information previously accessed. Also known as direct access. reversing layer [ASTROPHYS] Ed. 1: Cooler layer of thinner gases in the sun's atmosphere, just above the photosphere; it produces the dark lines in the sun's spectrum. Ed. 2: A layer of relatively cool gas forming the lower part of the sun's chromosphere, just above the photosphere, that gives rise to absorbtion lines in the sun's spectrum. shistosoma [INV ZOO] Ed. 1: A genus of blood flukes infecting man. Ed. 2: A genus of blood flukes infecting humans. slamming [NAV ARCH]

	Ed. 1: The impact of the ship's bow hitting the water during a severe downward pitch. Ed. 2: The impact of ship's bow hitting the water during a severe downward pitch. sponson mount [ORD] Ed. 1: A gun mount positioned on the sponson of a tank or combat vehicle; particularly abandoned on account of vulnerability and limited field of fire, although widely used in earlier tanks. Ed. 2: A gun mount positioned on the sponson of a tank or combat vehicle; particularly abandoned because of vulnerability and limited field of fire, although widely used in earlier tanks. thimerosal [ORG CHEM] Ed. 1: Sodium ethylmercurithiosalicylate, an organomercurial antiseptic used topically, and also as a preservative of certain biological products. Ed. 2: A light cream-colored, crystalline powder, soluble in water and alcohol; used as a topical antiseptic. Thiobacillus [MICROBIO] Ed. 1: A genus of rod-shaped autotrophic bacteria, using carbon dioxide as the sole source of carbon and deriving respiratory energy from the oxidation of sulfide, sulfur, thiosulfate, polythionates, and in some cases thiocyanate. Ed. 2: A genus of gram-negative, chemolithotrophic bacteria; motile, rod-shaped cells obtain energy by metabolizing sulfur compounds, including elemental sulfur, sulfides, thiosulfate, polythionates, and sometimes thiocyanate; carbon dioxide is the sole carbon source. Thiobacteriaceae [MICROBIO] Ed. 1: A family of nonfilamentous, gram-negative bacteria of the suborder Pseudomonadineae which oxidize hydrogen sulfide, free sulfur, and inorganic sulfur compounds to sulfuric acid. Ed. 2: Formerly a family of nonfilamentous, gram-negative bacteria of the suborder Pseudomonadineae characterized by the ability to oxidize hydrogen sulfide, free sulfur, and inorganic sulfur compounds to sulfuric acid. trivium [INV ZOO] Ed. 1: The three rays on the anterior side of an echinoderm. Ed. 2: The three rays opposite the madreporite in starfish.

	unitary transformation [MATH] Ed. 1: A linear transformation on a complex vector space which preserves inner products and norms. Ed. 2: A linear transformation on a vector space which preserves inner products and norms; alternatively, a linear operator whose adjoint is equal to its inverse. water ballast [NAV ARCH] Ed. 1: Seawater confined to double-bottom tanks, peak tanks, or other designated compartments, for use in obtaining satisfactory draft, trim, or stability. Ed. 2: Water confined to double-bottom tanks, peak tanks, or other designated compartments, for use in obtaining satisfactory draft, trim, or stability.
Change of number and a revised definition	Ed. 1: Halobacteria [MICROBIO] Rod-shaped bacteria which display extreme halophilism. Ed. 2: Halobacterium [MICROBIO] A genus of bacteria in the family Halobacteriaceae; single, rod-shaped cells which may be pleomorphic when media are deficient. Ed.1: halococci [MICROBIO] Coccoid bacteria which display extreme halophilism. Ed. 2: Halococcus [MICROBIO] A genus of bacteria in the family Halobacteriaceae; nonmotile cocci which occur in pairs, tetrads, or clusters of tetrads.
An additional meaning in an additional subject field	active component [ELEC] In the phasor representation of quantities in an alternating-current circuit, the component of current, voltage, or apparent power which contributes power, namely, the active current, active voltage, or active power. Also known as power component. active region [ELECTR] The region in which amplifying, rectifying, light emitting, or other dynamic action occurs in a semiconductor device. barycenter [ASTRON] The center of gravity of the earth-moon system. capstan [ENG] A shat which pulls magnetic tape through a machine at constant speed. closed shop

	[ADP] A data-processing center so organized that only professional programmers and operators have access to the center to meet the needs of users. declination [ASTRON] The angular distance of a celestial object north or south of the celestial equator. diagonal [OPTICS] A plane mirror or prism face mounted near the eyepiece of a telescope at an angle to the light path, to redirect the light for convenience of observation or to reduce the intensity of the image of the sun so that it can be observed directly. halo [ASTRON] A type of ray system in which many short, filamentary streaks form a complex network of bright matter surrounding the lunar crater. Also known as nimbus. land [DES ENG] The top surface of the tooth of a cutting tool, behind the cutting edge. loader [ADP] A computer program that takes some other program from an input or storage device and places it in memory at some predetermined address. pier [BUILD] A concrete block that supports the floor of a building. refractory [MED] Not readily yielding to treatment. revolution [MECH] The motion of a body around a closed orbit. scan [ELECTR] The motion, usually periodic, given to the major lobe of an antenna; the process of directing the radio-frequency beam successively over all point in a given region of space. total pressure [FL MECH] See dynamic pressure.
Several additional	base

meanings in an additional subject field	[ELECTR] 1. The region that lies between an emitter and a collector of a transistor and into which minority carriers are injected. 2. The part of an electron tube that has the pins, leads, or other terminals to which external connections are made either directly or through a socket. 3. The plastic, ceramic, or other insulating board that supports the magnetic powder of magnetic tape or the emulsion of photographic film. isobar [PHYS] 1. A line connecting points of equal pressure along a given surface in a physical system. 2. A line connecting points of equal pressure on a graph plotting thermodynamic variables.
Several additional meanings in several additional subject fields	inclination [GEOL] The angle at which a geological body or surface deviates from the horizontal or vertical; often used synonymously with dip. [SCI TECH] 1. Angular deviation of a direction or surface from the true vertical or horizontal. 2. The angle which a direction or surface makes with the vertical or horizontal. 3. A surface which deviates from the vertical or horizontal.
An additional meaning in an existing subject field	Boom [NAV ARCH] 2. A spar upon which the power side of a sail is bent. cutoff [ENG] 2. The line on a plastic object formed by the meeting of the two halves of a compression mold. Also known as flash groove; pinch-off. decision table [ADP] 2. See DETAB. drag [MET] 2. In thermal cutting, the distance deviating from the theoretical vertical line of cutting measured along the bottom surface of the material. gal [MECH] 1. The unit of acceleration in the centimeter-gram-second system, equal to 1 centimeter per second squared; commonly used in geodesic measurement. integral function [MATH] 2. See entire function.

	scan converter [ELECTR] 2. A cathode-ray tube that is capable of storing radar, television, and data displays for nondestructive readout over prolonged periods of time. step function [MATH] 2. More generally, a real function with finite range.
An additional name of the subject field	active component **[ELECTR]** See active element.
Additional information in the definition	air-standard cycle ...at 14.7 psi **(approximately 0.7756 m^3/kg at 101.36 kPa)**... air-traffic area [NAV] ... by a 5-statute-mile **(approximately 8 km)** ... to 2000 feet **(609.6 m)** average igneous rock [PETR] ... 10-mile (**16-kilometer**) shell ... caproic anhydride [ORG CHEM] ... **melting point -40.6^{0}C, boiling point 241-243^{0}C.** celo [MECH] ...1 foot per second **(0.3048 meter per second)** in one second. Chlamydobacteriaceae [MICROBIO] **Formerly** a family of gram-negative bacteria in the order Chlamydobacteriales possessing trichomes in which false branching may occur. Chlamydobacteriales [MICROBIO] **Formerly** an order comprising colorless, gram-negative, algae-like becteria of the class Schizomycetes. common rafter [BUILD] A rafter **which extends from the plate of the roof to the ridge board at right angles to both members, and** to which roofing is attached. declination [GEOPHYS] The angle between the magnetic and geographical meridians**, expressed in degrees and minutes east or west to indicate the direction of magnetic north from true north.**

	four-track tape [ENG ACOUS] ... length of 1/4 inch **(0.635 centimeter)** tape. lance [MED] To cut or open, as with a lancet **or bistoury.** mole [CHEM] ... **Symbolized mol.** parsec [ASTRON] ... **Derived from parallax-second.** rotating Reynolds number [Fl MECH] A nondimensional number arising in problems of a rotating viscous fluid **and, in particular, in problems involving the agitation of such a fluid by an impeller, equal to the product of the square of the impeller's diameter and its angular velocity divided by the kinematic viscosity of the fluid. Symbolized Re_r.** rotating viscometer vacuum gage [ENG] ... 1 millimeter of mercury **(133.32 newtons per square meter)** ...
Additional synonym(s)	binomial series [MATH]... **Also known as binomial expansion.** bulk modulus of elasticity [MECH] ... Also known as .... **modulus of compression;** .... cellulose nitrate [ORG CHEM] ... Also known as nitrocellulose; **nitrocotton.** homograft [BIOL] ... **Also known as allograft.** integral domain [MATH] ... **Also known as entire ring.** nuclear magnetometer [ENG] ... **Also known as nuclear resonance magnetometer.** parity [QUANT MECH] ... **Also known as space reflection symmetry.**

	propositional calculus [MATH] ... **Also known as sentential calculus.** quartic equation [MATH] ... **Also known as biquadratic equation.** rotational flow [FL MECH] ... **Also known as rotational motion.** thimerosal [ORG CHEM] ... **Also known as sodium ethylmercurithiosalicylate.**
An additional illustration	chloralase [ORG CHEM] chlorendic anhydride [ORG CHEM] podophyllotoxin [PHARM], but with a new term
Additional and/or updated illustration description	Meissner's corpuscle Drawing of Meissner's corpuscle. (*From F. A. Geldard, Human Senses, **2d ed., copyright (c)** 1972 **by John** Wiley **& Sons, Inc.; reprinted by permission***)
Definition instead of reference to another article	avalanche diode Ed. 1: See Zener diode. Ed. 2: [ELECTR] A semiconductor breakdown diode, usually made of silicone, in which avalanche breakdown occurs across the entire *pn* junction and voltage drop is then essentially constant and independent of currant; the two most important types are IMPATT and TRAPATT diodes. Chlamydia Ed. 1: See Bedsonia. Ed. 2: [MICROBIO] The single genus of the family Chylamydiaceae. permeability alloy Ed. 1: See permalloy. Ed. 2: [MET] An iron-nickel allor having greater magnetic susceptibility than iron.
Reference to another article instead of definition	galactic cluster Ed. 1: [ASTRON] Group of stars, not very concentrated in their central region, traveling in space as a group and having had a common origin; examples are the Pleiades and the Hyades. Also known as open cluster. Ed. 2: See open cluster.

	total curvature Ed. 1: [MATH] The total curvature of a surface at a point is given by the product of the principal curvatures there. Ed. 2: See Gaussian curvature
One definition deleted	scanner [ELECTR] The motion, usually periodic, given to the major lobe of an antenna; the process of directing the radio-frequency beam successively over all point in a given region of space.
Part of the definition deleted	binomial law [MATH] (The law that - del.) The probability of an even occurring r times in n Bernoulli trials is equal to ... Chlamydobacteriales [MICROBIO] Formerly an order comprising colorless, gram-negative, algae-like becteria of the class Schizomycetes (, which occur in trichomes - del.). flat trajectory [MECH] A trajectory which is relatively flat, that is, described by a projectile of relatively high velocity (; used to describe the trajectory of a rifle or gun as opposed to that of howitzers and mortars - del.). sym- [ORG CHEM] A chemical prefix; denotes structure of a compound in which substituents are symmetrical with respect to a functional group or to the carbon skeleton. (Abbreviation for symmetrical compounds. - del.) unitary transformation [MATH] A linear transformation on a (complex - del.) vector space which preserves inner products and norms.
Part of the illustration description deleted	Ramsden eyepiece [OPTICS] I_0=image ((real or virtual) - del.) formed by the preceding system; I_F=image ((virtual or real) - del.) formed by the preceding system and the field lens.
A reference to another article deleted	active component [ELECTR] See (active current, - del.) active element gal 2. See (galileo; - del.) gallon.
A synonym deleted	active current Also known as watt current (, active component - del.).

	air-traffic controller Also known as air traffic control officer (British usage). - del. Isinglass Also known as fish gelatin; (fish glue; - del.) ichthyocolla.
An illustration deleted	air-suspension system [MECH ENG] communication cable [COMMUN] electron linear accelerator [NUCLEO] electron microscope [PHYS] leucite [MINERAL] Megger [ELEC] Picturephone [COMMUN] prairie dog [VERT ZOO] quark [PARTIC PHYS] ramie [BOT] rotation camera [SOLID STATE] shock wave [PHYS] spontaneous-potential well logging [ENG] Trombidiformes [INV ZOO]
Altered order of definitions	Aspiration Ed.1: [SCI TECH] Act or the result of removing, carrying along, or drawing by suction. [MED] The removal of fluids from a cavity by suction. [MICROBIOL] The use of suction to draw up a sample in a pipette. Ed. 2: [MED] The removal of fluids from a cavity by suction. [MICROBIOL] The use of suction to draw up a sample in a pipette. [SCI TECH] Act or the result of removing, carrying along, or drawing by suction. dial Ed. 1: [DES ENG] A separate scale or other device for indicating the value to which a control is set. [ELECTR] In automatic

	telephone switching, a type of calling device which, when would up and released, generates pulses required for establishing connections. Ed. 2: [COMMUN] In automatic telephone switching, a type of calling device which, when would up and released, generates pulses required for establishing connections. [DES ENG] A separate scale or other device for indicating the value to which a control is set.

Table 15. New Entries in Edition 3, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields:	**Entries:**
No subject field	active door asphalt base asphalt stone binding coal Boolean data type boot button chlorargyrite close-joints cleavage close sand CPR giant pulse laser giant's cauldron green chalcedony greenlandite halmyrogenic incandescent tuff flow integrated-circuit memory lancet arch lixuration neutral species nuclear twin-probe gage open-circle deoxyribonucleic acid picture processing podiform orebody poikilocrystallic prase opal quarry sap ram penetrometer revived folding slag wool step lake subcomsequent stream thin list trityl radical Venus hairstone Wurster process
AERO ENG aerospace engineering	active controls technology
ARCH architecture	avant-corps

ASTRON astronomy	active galaxy baryon-to-photon ratio closed universe galaxy cluster
BIOCHEM biochemistry	homopolysaccharide lyngbyatoxin a
BIOL biology	stenoplastic stenotherm stenothermic
BOT botany	diaheliotropism
BUILD building construction	active leaf antismudge ring base anchor slamming stile
CHEM chemistry	amphiphile contemporary carbon regenerant subcompound
CHEM ENG chemical engineering	air-suspension encapsulation permeator
CIV ENG civil engineering	active earth pressure active sludge air-to-air resistance antirad asphalt leveling course asphalt overlay asphalt pavement asphalt soil stabilization
COMMUN communications	pragmatics teletext
COMP SCI computer science	activation record available space list Boolean search bootstrap button bootstrap loader closed file close routine communication protocol content analysis contention resolver context-driven line editor context-free grammar context-sensitive grammar direct-entry terminal

	direct hierarchy control echoplex technique expanded batch ghost algebraic manipulation language integer data type microcomputer development system microdiagnostic program open file picture compression picture grammar picture segmentation proprietary program rotational latency symbolic algebraic manipulation language teleprocessing monitor total deadlock
CRYO cryogenics	fourth sound
CRYSTAL crystallography	open-packed structure rotational transformation scalenohedron
DES ENG design engineering	diagonal pliers flat belt
ECOL ecology	amphitropical distribution declining population open community refugium stenotopic subdominant
ELEC electricity	stepped-wave static inverter
ELECTR electronics	available power avalanche noise common-mode gain common-mode input capacitance common-mode input impedance common-mode input resistance direct-current squid
ENG engineering	asphalt heater basal tunnel bascule boomerang sediment corer bootstrap deckle deckle strap

	diagnostics echosonogram expanded-flow bin integraph nuclear snow gage open-circuit scuba open hole quarry water ramsonde refraction profile refraction shooting scanning proton microprobe scanning radiometer slack time slant drilling subbottom depth recorder telerecording bathythermometer telescopic alidade
ENG ACOUS engineering acoustics	average acoustic output echo repeater sonar boomer transducer
FL MECH fluid mechanics	trochoidal wave
FOOD ENG food engineering	Melangeur
FOREST forestry	Slash
GEN genetics	amphiploid antisense exon isoallele
GEOGR geography	cove neutral estuary
GEOL geology	asperity exorheic Ferrod giant’s kettle Hallian halmeic Hemist katazone Lanarkian Lancastrian mélange neutral shoreline

	open fault overstep overwash mark parogenetic permeability trap piecemeal stoping piedmont angle piedmont gravel piedmont plateau podzolization pokiloblast poikilophitic poikilotope poikilotopic prarie soil rambla rampart rampart wall Rancholabrean Refugian reg reversing dune revet-crag rotational bomb rotational landslide rotational movement scalloped upland selenite butte shock lithification shock zone shoestring rill slab jointing spodic horizon stephanian telescope structure Venturian
GEOPHYS geophysics	four-way dip shock loading shock melting stepout time
GRAPHICS graphic arts	bulk flat etching
HYD hydrology	basal groundwater basal water table closed lake

	expanded foot open lake piedmont lake randkluft regenerated flow control
IMMUNOL immunology	direct immunofluorescence
MAP mapping	eckert projection
MATER materials	antislip paint asphalt base crude asphalt block asphalt-emulsion slurry seal asphalt fog seal asphaltic base oil asphaltic concrete asphalt lamination bulk molding compound manifold paper water gas
MATH mathematics	diagonally dominant matrix Kármán swirling flow problem Karush-Kuhn-Tucker conditions Tournament
MECH ENG mechanical engineering	asphalt cutter boom cat booster brake refrigeration system
MED medicine	communication disorder flatus piebaldism Reye's syndrome spontaneous pneumothorax subcutaneous emphysema
MET metallurgy	bull ladle
METEOROL meteorology	active front
MIN ENG mining engineering	prospect pit prospect shaft
MINERAL mineralogy	prase prasopal randannite
MOL BIO molecular biology	active site antisense strand

	isoacceptor permissive cell
NUCLEO nucleonics	decommissioning rotating crystal source
NUC PHYS nuclear physics	p-process
OCEANOGR oceanography	average limit of ice closed sea overtide overwash pool
ORG CHEM organic chemistry	exocyclic double bond homologation isoalkane isoalkyl group
PETR petrology	permeation gneiss prasinite shoal breccia shock breccia
PETRO ENG petroleum engineering	propping agent prospecting seismology
PHYS physics	scanning HEED
PHYS CHEM physical chemistry	lyotropic liquid crystal permselective membrane random coll
PHYSIO physiology	galactopoiesis homoiothermal total lung capacity
PL PATH plant pathology	exopathogen exopathogenesis
PL PHYS plasma physics	diagravitropism
RELAT relativity	dragging of inertial frames
SOLID STATE solid-state physics	asperomagnetic state
SPECT spectroscopy	electron nuclear double resonance nuclear reaction spectrometry
SYS ENG systems engineering	cut constraint cut methods
TEXT textiles	binche lace bulked yarn galatea kasha lyons velvet

THERMO thermodynamics	Poynting’s law

Table 16. Entries Deleted in Edition 3, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields:	**Entries:**
BIOL biology	homograft
IMMUNOL immunology	isoantibody
INV ZOO invertebrate zoology	shistosoma
GEOL geology	katamorphism
MET metallurgy	Hymu
MICROBIO microbiology	Mycostatin Ampicillin Declomycin
TEXT textiles	Verel Caprolan

Table 17. Changes in the Microstructure of Edition 3, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Types of changes	**Changes**
Grammar corrected in the definition	closed-circuit communications system [COMMUN] Ed. 2: Certain communications systems which are entirely self-contained, and do not exchange intelligence with other facilities and systems. Ed. 3: A communications system which is entirely self-contained, and does not exchange intelligence with other facilities and systems.
A revised definition	bascule bridge [CIV ENG] Ed. 2: A bridge structure with a cantilever span which can be raised for passing vessels. Ed. 3: A movable bridge consisting primarily of a cantilever span extending across a channel; it rotates about a horizontal axis parallel with the waterway. biochemical fuel cell [ELEC] Ed. 2: A projected fuel cell in which small amounts of electric power will be produced continuously for many years by some form of biological system. Ed. 3: An electrochemical power generator in which the fuel source is bioorganic matter; air is the oxidant at the cathode, and microorganisms catalyze the oxidation of the bioorganic matter at the anode. deck bridge [CIV ENG] Ed. 2: A type of bridge in which the supporting members are all beneath the roadway. Ed. 3: A bridge that carries the deck on the very top of the superstructure. selector channel Ed. 2: [ADP] A piece of hardware which allows more than one high-speed input/output device to be accessed by line computer. Ed. 3: [COMPUT SCI] A unit which connects high-speed input/output devices, such as magnetic tapes, disks, and drums, to a computer memory. Spodosol [GEOL] Ed. 2: A soil order characterized by a spodic or placic horizon overlying a fragipan. Ed. 3: A soil order characterized by accumulations of amorphous

	materials in subsurface horizons. telescope [OPTICS] Ed. 2: An optical instrument which, in order to obtain a better resolution, increases the angle under which a distant object, terrestrial or astronomical, is seen. Ed. 3: An assemblage of lenses or mirrors, or both, that enhances the ability of the eye either to see objects with greater resolution or to see fainter objects.
An additional meaning in an additional subject field	activation [MOL BIO] A change that is induced in an amino acid before it is utilized for protein synthesis. chlorination [TEXT] A process in which wool is treated with a solution of hypochlorite and an acid or similar mixture to reduce the tendency of the fiber to shrink by matting. cut point [MATH] A point in a component of a graph whose removal disconnected that component. diagnosis [SYST] In taxonomic study, a statement of the characters that distinguish a taxon from coordinate taxa. echogram [MED] The pictorial display of anatomical structures using pulse-echo technique. homology [CHEM] The relation among elements of the same group, or family, in the periodic table. intarsia [FA TEXT] A pattern in several colors, usually geometrical, in a knitted fabric in which both sides of the fabric are alike. isinglass [MINERAL] Sheet mica, usually in the form of single cleavage plates; used in furnace and stove doors. point [GRAPHICS] A printer’s unit of measurement, equivalent to 1/72 or 0.013837 inch (0.3514598 millimeter) or 1/12 pica.

	scallop [GEOL] See scalloping. scalloping [GEOL] A sedimentary structure superficially resembling an oscillation ripple mark, and having a concave side that is always oriented toward the top of the bed. slack [GEOL] A hollow or depression between lines of shore dunes or in a sandbank or mudbank on a shore. sponge [CHEM ENG] Wood shavings coated with iron oxide and used as a catalyst in processes for removing hydrogen sulfide from industrial gases. step [ORG CHEM] See elementary reaction. telescope [ENG] Any device that collects radiation, which may be in the form of electromagnetic or particle radiation, from a limited direction in space.
Several additional meanings in an additional subject field	cutoff [CIV ENG] 1. A channel constructed to straighten a stream or to bypass large bends, thereby relieving an area normally subjected to flooding or channel erosion. 2. An impermeable wall, collar, or other structure placed beneath the base or within the abutments of a dam to prevent or reduce losses by seepage along otherwise smooth surfaces or through porous strata. homologous [GEOL] 1. Referring to strata, in separated areas, that are correlatable (contemporaneous) and are of the same general character or facies, or occupy analogous structural positions along the strike. 2. Pertaining to faults, in separated areas, that have the same relative position or structure.
Several additional meanings in several additional subject fields	base [CHEM ENG] The primary substance in solution in crude oil, and remaining after distillation. [COMPUT SCI] See root. [LAP] See pavilion.

	contamination [GEOL] A process in which the chemical composition of a magma changes due to the assimilation of country rocks. [HYD] The addition to water of any substance or property that prevents its use without further treatment. overprint [GEOCHEM] A complete or partial disturbance of an isolated radioactive system by thermal, igneous, or tectonic activities which results in loss or gain of radioactive or radiogenic isotopes and, hence, a change in the radiometric age that will be given the disturbed system. [GEOL] The development or superposition of metamorphic structures on original structures.
An additional meaning in an existing subject field	antiquing [ENG] 2. A technique of handling wet paint to expose parts of the undercoat, by combing, graining, or marbling. aspect ratio [DES ENG] 2. In any rectangular configuration (such as the cross section of a rectangular duct), the ratio of the longer dimension to the shorter. bullet [ENG] 5. See torpedo. load [ENG] 2. The quantity of gas delivered or required at any particular point on a gas supply system; develops primarily at gas-consuming equipment. overwash [GEOL] 1. A mass of water representing the part of the wave advancing up a beach that turns over the highest part of the berm (or other structure) and that does not flow directly back to the sea or lake. paroxysm [MED] 3. A burst of electrical activity during electroencephalography in the form of spikes, or spikes and waves, which indicates cerebral dysrhythmia or epileptic discharges.
Additional synonym(s)	antiquing [ENG] ... **Also known as broken-color work.**

	asphalt mastic [MATER] ... **Also known as mastic asphalt.**
One definition deleted	capping [MET] Separation of a compact into two or more portions by making diagonal cracks which originate near the edges of the punch aces.
An illustration deleted	karst [GEOL] lizard [VERT ZOO] llama [VERT ZOO] microcircuitry [ELECTR]
Altered order of definitions	contention [COMMUN] A method of operating a multiterminal communication channel in which any station may transmit if the channel is free; if the channel is in use, the queue of contention requests may be maintained in predetermined sequence. [COMPUT SCI] The condition arising when two or more units attempt to transmit over a time-division-multiplex channel at the same time. teleprinter [COMMUN] A device that responds to teletype signals and prints the corresponding characters on paper tape. [COMPUT SCI] Any type-writer device capable of being connected to a computer and of printing out a set of messages under computer control. verify [COMMUN] To ensure that the meaning and phraseology of the transmitted message convey the exact intention of the originator. [COMPUT SCI] To determine whether an operation has been completed correctly, and in particular, to check the accuracy of keypunching by using a verifier.

Table 18. New Entries in Edition 4, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields	**Entries**
No subject field	antiroll bar antisound antisway bar available time boom ratchet cover sheet electronic support measures flat-panel display ISFET isobaric analog states LAN megaspore mother cell microfloppy disk molded silver nitrate PP reaction refractive constant revolute-coordinate robot Rf selectively doped heterojunction transistor
ACOUS acoustics	scanning acoustic microscope
ARCHEO archeology	bioarcheology
ASTRON astronomy	flatness problem Lyot division molecular cloud neutral region nuclear time scale quark star R galaxy Sombrero galaxy symbiotic star Telesto
ATOM PHYS atomic physics	gf-value
BIOCHEM biochemistry	somatostatin
BIOL biology	Lysenkoism meiospore
BOT	megasporocyte

botany	microgametophyte mycobiont open bundle
CHEM ENG chemical engineering	anti-redeposition agent reversion
COMMUN communications	communication control unit integral modem teleport teleseminar
COMP SCI computer science	antistatic mat bulletin board close-out file communicating word processor communications package contextual analysis courseware CPU-bound program cut-sheet printer diagnostic message dialect dialog direct input/output electronic typewriter fourth-generation computer fourth-generation language getmain integrated data dictionary manifest constant power typing pragma rampage through core reformat refresh rotational delay switch selectable addressing symbolic mathematical computation symbolic name teleterminal thimble think time touch screen
CONT SYS control systems	cut-in cut-out touch sensor
CRYO	kapitza resistance

cryogenics	quantum turbulence
ECOL ecology	meiofauna meioflora
ELEC electricity	air-variable capacitor closed-coil armature neutral step angle
ELECTR electronics	avalanche impedance avalanche voltage biochip cut-in angle cutout angle Hall resistance integral quantum Hall effect point-contact silicon cell quantum wire
ELECTROMAG electromagnetism	spontaneous emission
ENG engineering	close nipple cutover dialing step dial weight draft hood flat-plate collector
GRAPHICS graphic arts	average gradient base area cut plane microcopy
HYD hydrology	subartesian well
IND ENG industrial engineering	availability ratio average sample number island of automation
INV ZOO invertebrate zoology	epitoky Greeffielloidea
MATER materials	asphalt enamel asphaltic material expanded perlite molded coal
MATH mathematics	bullet nose diakoptics epi spiral kappa curve Poinsot’s spiral scaling symmetry

	unitary matrix
MECH mechanics	bulk strain Poincaré surface of section
MECH ENG mechanical engineering	air-tube clutch antirattle spring boom dog boom stop close-off rating common-rail injection load-carrying capacity load deflection revolute joint rotational traverse spongy total coincidence
MED medicine	hyperacusia mycobacterial disease (instead of mycobacterium, mycobacterium leprae, and mycobacterium tuberculosis) nuclear medicine nuclear medicine imaging parous
MET metallurgy	molding board
METEOROL meteorology	nuclear winter
MICROBIO microbiology	Capnocytophaga
MOL BIO molecular biology	base analog
NAV navigation	integrated inertial navigation system
NAV ARCH naval architecture	integrated ducted propeller
NUCLEO nucleonics	containment building nuclear teleoperator total energy ball
NUC PHYS nuclear physics	giant nuclear resonance nuclear molecule nuclear orientation nuclear response function quark-gluon plasma
OCEANOGR oceanography	lysocline
OPTICS	integral hologram

optics	
PARTIC PHYS particle physics	quarkonium unitarity condition
PETRO ENG petroleum engineering	bullet perforator cement bond cement-bond survey cement channeling cementing basket chlorine survey close in open-hole completion
PHYS physics	barytopic gas
PHYS CHEM physical chemistry	molecular cluster rotational transition
SPECT spectroscopy	Fourier transform spectroscopy
VIROL virology	Capripoxvirus
ZOO zoology	oviposit

Table 19. Entries Deleted in Edition 4, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields:	**Entries:**
No subject field	capraldehyde capric aldehyde caproaldehyde caproic aldehyde capryaldehyde chloracetone chloracetophenone chloramben chlorinated acetone 4-diallylamino-3,5-xylyl-*n*-methylcarbamate *n*,*n*-diallyl-2-chloroacetamide diallyl sulfide 1,2-epoxybutane 2,3-epoxy-1-propanol galactitol *ortho*-homosalicylic acid 4-homosulfanilamide isoamyl isovalerate micrococcus meningitidis molectronics mycoin c_3 picronitric acid s-propyl butylethylthiocarbamate propyl cyanide s-propyldipropylthiocarbamate propylene chloride propylene glycol methyl ether propylformic acid propyl para-hydroxybenzoate refracture index thioallyl ether thiocarbamisin thiocarbanil thiodiethylene glycol
ANALY CHEM analytical chemistry	ramsbottom coke test
BIOL biology	avena unit capon unit
CHEM ENG chemical engineering	chlorex process rexforming

	stengel process trona process unisol process
COMMUN communications	communications satellite corporation man-made interference man-made noise
ELECTR electronics	thin magnetic film
ENG engineering	ramsbottom safety valve shirley-ferranti viscometer uniontown method
GRAPHICS graphic arts	drafting machine
INV ZOO invertebrate zoology	Hymenolepis nana
MICROBIO microbiology	micrococccus microcyclus microellobosporia mycoplasma mycoplasma pneumoniae selenomonas symbiotes thiobacillus thiobacterium thiocapsa thiocystis thiodendron thiodictyon
MYCOL mycology	aspergillus fumigatus aspergillus niger
ORG CHEM organic chemistry	parinol thimerosal 2-(thiocyanomethylthio)benzothiazole
PETR petrology	Llerzolite
TEXT textiles	man-made fiber

Table 20. Changes in the Microstructure of Edition 4, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Types of Changes	**Changes**
A revised definition	baryon number [PARTIC PHYSICS] Ed. 3: A conserved quantum number, equal to he number of baryons minus the number of antibaryons in a system; neutrons and protons have baryon number one; mesons and leptons have baryon number zero. Ed. 4: A quantum number equal to the number of baryons minus the number of antibaryons in a system; it is conserved at the present level of detection, but may not be exactly conserved. capsid Ed. 3: [VIROL] The protein coat of a virus particle. Ed. 4: [VIROL] In a virus, the protein shell surrounding the nucleic acid and its associated protein core. communication protocol Ed. 3: [COMPUT SCI] The exchange of a special sequence of control characters between a computer and a remote terminal in order to establish synchronous communication. Ed. 4: [COMPUT SCI] Procedures that enable devices within a computer network to exchange information. cutoff Ed. 3: [ELECTR] The minimum value of negative grid bias that will prevent the flow of anode current in an electron tube. Ed. 4: [ELECTR] The minimum value of bias voltage, for a given combination of supply voltages, that just stops output current in an electron tube, transistor, or other active device. directional drilling Ed. 3: [ENG] A method of drilling in which the direction of the hole is planned before. Ed. 4: [ENG] A drilling method involving intentional deviation of a wellbore from the vertical. echovirus Ed. 3: [VIROL] A division of enteroviruses in the picornavirus group; the name is derived from the group designation enteric cytopathogenic human orphan virus. Ed. 4: [VIROL] Any member of the Picornaviridae family, genus *Enterovirus*; the name is derived from the group designation

	enteric cytopathogenic human orphan virus. epitope [IMMUNOL] Ed. 3: A single determinant of an antigen or immunogen which influences its specificity (immunology). Ed. 4: The portion of the antigen molecule that determines its capacity to combine with the specific combining site of its corresponding antibody in an antigen-antibody interaction. flavanone [BIOCHEM] Ed. 3: A colorless crystalline derivative of flavone. Ed. 4: A colorless crystalline ketone, that often occurs in plants in the form of a glycoside. molecular electronics [ELECTR] Ed. 3: The branch of electronics that deals with the production of complex electronic circuits in microminiature form by producing semiconductor devices and circuit elements integrally while growing multizoned crystals in a furnace. Ed. 4: The systematic use of molecular materials to produce new or improved electronic devices. ramp mining [MIN ENG] Ed. 3: The development of moderately inclined accessways from the surface to mining levels for haulage of ore, materials, waste, **men**, and equipment. Ed. 4: The development of moderately inclined accessways from the surface to mining levels for haulage of ore, materials, waste, **workers**, and equipment. scandium [CHEM] Ed. 3: A metallic group III element, symbol Sc, atomic number 21; melts at 1200^0C; found associated with rare-earth elements. Ed. 4: A transition element, symbol Sc, atomic number 21; melts at 1200^0C; found associated with rare-earth elements. unitary symmetry [PARTIC PHYS] Ed. 3: An approximate symmetry law obeyed by the strong interactions of elementary particles; it may be described as the equivalence of three fundamental particles, termed quarks, out of which all hadrons could be assumed to be composed. Ed. 4: An approximate internal symmetry law obeyed by the strong interactions of elementary particles; a system of particles has such a symmetry if all the particles can be described as compounds of a fundamental multiplet of particles, and if all

	physical properties of the system are unchanged by an arbitrary unitary transformation of this fundamental multiplet.
Altered illustration	Cenozoic [GEOL] Reversed order of eras; the content is the same permian [GEOL] Reversed the table; the content is the same.
An additional meaning in an additional subject field	base [GRAPHICS] A transparent plastic film on which a photographic emulsion is applied. boom [MECH ENG] A movable steel arm installed on certain types of cranes or derricks to support hoisting lines that must carry loads. boomer [ENG] A device used to tighten chains on pipe or other equipment loaded on a truck to make the cargo secure. booster [MECH ENG] A compressor that is used as the first stage in a cascade refrigerating system. boot [COMPUT SCI] To load the operating system into a computer after it has been switched on; usually applied to small computers. bootstrap [COMPUT SCI] The procedures for making a computer or a program function through its own actions. bull nose [MET] A ladle used in foundry operations for carrying molten metal. capping [MOL BIO] Addition of a methyl group to the guanine nucleotide at the end of a eukaryotic messenger RNA molecule after transcription. closed system [ENG] A system for water handling that does not permit air to enter. contamination

	[COMPUT SCI] Placement of data at incorrect locations in storage, where it generally overlays valid information or a program code and produces bizarre results. cutoff [AERO ENG] The shutting off of the propellant flow in a rocket, or the stopping of the combustion of the propellant. get [COMPUT SCI] An instruction in a computer program to read data from a file. homology [BIOL] A fundamental similarity between structures of processes in different organisms that usually results from their having descended from a common ancestor. manipulators [CONT SYS] An armlike mechanism on a robotic system that consists of a series of segments, usually sliding or jointed which grasp and move objects with a number of degrees of freedom, under automatic control. neutral point [PHYS] A point where two fields are equal in magnitude and opposite in direction so that the net field is zero. overrun [COMPUT SCI] The arrival of an amount of data greater than the space allocated to it. pragmatics [COMPUT SCI] The fourth and final phase of natural language processing, following contextual analysis, that takes into account the speaker's goal in uttering a particular thought in a particular way in determining what constitutes an appropriate response. proprioceptor [CONT SYS] A device that senses the position of an arm or other computer-controlled articulated mechanism or a robot and provides feedback signals. rotation [COMP SCI] An operation performed on data in a register of the central processing unit, in which all the bits in the register are

	shifted one position to the right or left, and the endmost bit, which is shifted out of the register, is carried around to the position at the opposite end of the register. scaling [NUC PHY] A property of nuclear collisions whereby the likelihood of a nuclear reaction depends more on the ration between energy transferred and momentum transferred than on the energy transferred between the colliding particles. scan [COMPUT SCI] To examine information, following a systematic, predetermined sequence, for some particular purpose. union [COMPUT SCI] A data structure that can store items of different types, but can store only one item at a time.
Several additional meanings in several additional subject fields	aspect ratio [MECH ENG] In an automotive vehicle, the ration of the height of a tire to its width. [NUCLEO] The ration of the plasma diameter of a toroidal controlled fusion device to the major diameter of the torus. ghost image [OPTICS] An undesired image appearing at the image plane of an optical system; it may be a false image of the object or an out-of-focus image of a bright source of light in the field of the optical system. [SPECT] A false image of spectral line produced by irregularities in the ruling of a diffraction grating.
An additional meaning in an existing subject field	contention [COMPUT SCI] 2. Competition for the same computer resources by two or more devices or programs, such as an attempt by several programs to use the same disk drive simultaneously, or by several users in a multiaccess system to use the system's resources. ecliptic [ASTRON] 2. The plane of the earth's orbit around the sun. load [COMPUT SCI] 4. The amount of work scheduled on a computer system, usually expressed in hours of work. selectivity

	[ELECTR] 2. The inverse of the shape factor of a bandpass filter.
Several additional meanings in an existing subject field	epoxide [ORG CHEM] 2. A three-membered cyclic ether. 3. See ethylene oxide.
Additional information in the definition	exosphere [METEOROL] An outermost region of the atmosphere, estimated at **300-600 miles** (500-1000 kilometers) ... hemipelagic region [OCEANOGR] The region of the ocean extending from the edge of a shelf to the pelagic environment; roughly corresponds to the bathyal zone, in which the bottom is **660 to 3300 feet** (200 to 1000 meters) below the surface. homosphere [METEOROL] the lower portion of a two-part division of the atmosphere (the upper portion is the heterosphere) according to the general homogeneity of atmospheric composition; the region in which there is no gross change in atmospheric composition, that is, all of the atmosphere from the earth's surface to about **50 to 62 miles** (80-100 kilometers). hyperacoustic zone [GEOPHYS] The region in the upper atmosphere, between **62 and 100 miles** (100 and 160 kilometers)... isobryales [BOT] An order of mosses in which the plants are slender to robust and up to **36 inches** (90 centimeters) in length. trochoid [MATH] The path in the plane obtained from a point on the radius of a circle **or the extension of the radius** as the circle rolls along a fixed straight line.
Additional synonym(s)	capsid [VIROL] .... **Also known as protein coat.** electronic warfare support measures [ELECTR] ... **Also known as electronic support measures.** microchannel plate [ELECTR] ... **Also known as channel plate multiplier.** picture segmentation

	[COMPUT SCI] ... Also known as scene analysis; **segmentation.**
An additional illustration	karst [GEOL] teleterminal [COMPUT SCI], but the term was also new
Abbreviation explained	air-standard cycle [THERMO] Ed. 3: ft^3/lb; psi; m^3/kg; kPa Ed. 4: cubic feet per pound; pounds per square inch; cubic meters per kilogram; kilopascals
Reference to another article instead of definition	manipulators [ENG] Ed. 3: Mechanical devices used for safe handling of dangerous materials of any kind, especially radioactive materials; frequently, they are remotely operated from behind a protective shield. Ed. 4: See remote manipulator.
Part of the definition deleted	electron lepton number [PARTIC PHYS] Ed. 3: The number of electrons and electron-associated neutrinos minus the number of positrons and electron-associated antineutrons; **believed to be an exactly conserved quantity. - del.** Ed. 4: The number of electrons and electron-associated neutrinos minus the number of positrons and electron-associated antineutrons.
A synonym deleted	capric acid [ORG CHEM] Also known as *n*-decanoic acid; decatoic acid; *n*-decoic acid; decyclic acid; octylacetic acid. - del. caproic acid [ORG CHEM] Also known as butylacetic acid; hexanoic acid; *n*-hexoic acid; *n*-hexylic acid; pentylformic acid. - del. chloflurecol methyl ester [ORG CHEM] Also known as methyl-2-chloro-9-hydroxyfluorene-9-carboxylate. - del. chloranil [ORG CHEM] Also known as tetrachloroquinone. - del. chlorbenside [ORG CHEM] Also known as *para*-chlorobenzyl-*para*-chlorophenyl sulfide. - del. chlorbromuron [ORG CHEM] Also known as3-(4-bromo-3-chlorophenyl)-1-methoxy-1-methylurea. - del.

	chlordimeform [ORG CHEM] Also known as N'-(4-chloro-*ortho*-tolyl)-N, N-dimethylformamidine. - del. chlorfenethol [ORG CHEM] Also known as 1,1,-bis(4-chlorophenyl)ethanol. - del. chlorfenpropmethyl [ORG CHEM] Also known as 2-chloro-3-(4-chlorophenyl)-methylpropionate. - del. chlorfensulfide [ORG CHEM] Also known as 4-chlorophenyl-2,4,5-trichlorophenylazosulfide. - del. chlorfenvinphos [ORG CHEM] Also known as 2-chloro-1-(2,4-dichlorophenyl)-vinyl. - del. dialifor [ORG CHEM] Also known as *S*-(2-chloro-1-phthalimidoethyl) *O*,*O*-diethyl phosphorodithioate. - del. dialuric acid [ORG CHEM] Also known as 5-hydroxybarbituric acid. - del. hymecromone [ORG CHEM] Also known as 7-hydroxy-4-methyl-2-oxo-3-chromene; imecromone; ß-methylumbelliferone. - del. isethionic acid [ORG CHEM] Also known as ethylenehydrinsulfonic acid; oxyethylsulfonic acid. - del. isoamyl bromide [ORG CHEM] Also known as 1-bromo-3-methylbutane - del. isoamyl valerate [ORG CHEM] Also known as apple essence; apple oil; isoamyl isovalerate. - del. isobutane [ORG CHEM] Also known as 2-methyl propane. - del. karbutilate [ORG CHEM] Also known as *meta*-(3,3-dimethylureido)phenyl-*tert*-

	butylcarbamate. - del. melamine [ORG CHEM] Also known as cyanurtriamide; 2,4,6-triamino-*s*-triazine. - del. molecular electronics [ELECTR] Also known as molectronics. - del. picric acid [ORG CHEM] Also known as carbazotic acid; nitroxanthic acid; picronitric acid; trinitrophenol. - del. propylene dichloride [ORG CHEM] Also known as 1,2-dichloropropane; propylene chloride. - del. propylene glycol [ORG CHEM] Also known as 1,2-dihydroxypropane; methyl ethylene glycol; methyl glycol; 1,2-propanediol. - del. propylene glycol monomethyl ether [ORG CHEM] Also known as propylene glycol methyl ether. - del. propylhexedrine [ORG CHEM] Also known as 1-cyclohexyl-2-methylaminopropane; *N*-dimethylcyclohexaneethylamine - del. propylparaben [ORG CHEM] Also known as propyl *para*-hydroxybenzoate. - del. thiocarbamazine [PHARM] Also known as (*para*-ureidophenylarsylenedithio)di-*ortho*-benzoic acid; thiocarbamisin. thiocarbanilide [ORG CHEM] Also known as (*N,N'*-diphenylthiourea; - del.) sulfocarbanilide. thiocarbarsone [PHARM] Also known as (*para*-ureidophenylarsylenedithio)diacetic acid. - del. thiocyanate [INORG CHEM] Also known as (rhodanate; rhodanide; - del.) sulfocyanate; sulfocyanide; thiocyanide. tropeoline 00 [ORG CHEM]

	Also known as sodium *para*-diphenylaminoazobenzene sulfonate. - del. unitary symmetry [PARTIC PHYS] Also known as SU_3 symmetry. - del.
An illustration deleted	chlamydospore [MYCOL] hemoglobin [BIOCHEM] hylobatidae [VERT ZOO] hymecromone [ORG CHEM] lettuce [BOT] open channel [SCI TECH] Shirley-Ferranti viscometer [ENG], but the term was deleted as well
Altered order of definitions	selector [CIV ENG] A device that automatically connects the appropriate railroad signal to control the track selected. [COMPUT SCI] Computer device which interrogates a condition and initiates a particular operation dependent upon the report.

Table 21. New Entries in Edition 5, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields	**Entries**
No subject field	basal complex bulk sample communicating junction content continental displacement CPD CUT emulation declaration EPMA homothetic ratio inactivated vaccine incircle karst fenster karyodesma leuco compound LMXRB manipulative grasp megasporogenesis megass molding sand mold seam neutralization reaction propositus ram disk refracting angle symbiotic nova totient toughened glass wye branch wye fitting
ACOUS acoustics	flat-top boom
ANALY CHEM analytical chemistry	bulk sampling
ASTRON astronomy	galactic bulge galactic corona Galatea Great Wall Parker model subcluster

ASTROPHYS astrophysics	Parker bound
BIOCHEM biochemistry	integrase
BIOL biology	homoplastic
BOT botany	C_3 plant C_4 plant homoplastidy somatic embryogenesis
BUILD building construction	oversail oversite concrete swivel spindle water bar
CHEM chemistry	homonuclear molecule lyonium ion molecular entity molecular formular neutralization permeant quarterpolymer selective poisoning
CHEM ENG chemical engineering	air stripping chloralkali chloralkali process microfiltration permeate
CIV ENG civil engineering	closer overtopping overturning permissive block system
COMMUN communications	dial-up telephone system
COMP SCI computer science	communications program context-sensitive help contextual search contiguous data dialog box greeking megapel display parser power up RAM drive RAM resident RGB monitor

	SPMD uniprocessor
CONT SYS control systems	telepresence telerobot
CYTOL cytology	echylosis ghost layer karyosphere nuclear pore complex nuclear transfer
DES ENG design engineering	bull-nose plane paring chisel paring gouge
ECOL ecology	flatwood
ELEC electricity	lamp depreciation lamp inrush current neutral safety switch power transfer equation troffer water dropper
ELECTR electronics	common-mode rejection ration electron refraction open-flame arc power-supply rejection ratio quantum well scan head scan line selective photoelectric effect thin-film field-emitter cathode
ENG engineering	bulge forming expander flange four-pi counter Kapitza balance microdiffusiometer molecular gage ramping televiewer tow Wulf electrometer
EVOL evolution	incipient species
FL MECH fluid mechanics	Kármán-Tsien method Prandtl-Glauert rule Prandtl-Meyer flow Reynolds-averaged Navier-Stokes analysis

	total head
FOOD ENG food engineering	neutral spirits
GEN genetics	exon shuffling homokaryotype inbreeding coefficient inbreeding depression lethal equivalent value megaphenic meiotic drive neutral mutation permissive condition somatoclonal variation
GEOL geology	continental divide karren karst base level karstification karst window
GEOPHYS geophysics	microearthquake
GRAPHICS graphic arts	electron radiography
IMMUNOL immunology	eclipsed antigen isoantibody
IND ENG industrial engineering	available motions inventory biochemical profile bulk material homologous motion incentive operator manipulative skill Pareto's law permissible exposure limit
MATER materials	binding agent bulk solid cement temper green concrete green mortar
MATH mathematics	antipodal points antisymmetric relation average curvature base angle boolean Boolean determinant Boolean matrix Boolean operation table

	Boolean operator Boolean ring closed covering closed curve closed linear transformation closed map closed n-cell closed surface contiguous functions continuant continuant matrix continued equality covariant derivative diagonalize diagonal matrix flat space Fourier kernel Fourier's half-range series four-point fourth quadrant fourth proportional Gershgorin's method homothetic curves homothetic figures homothetic transformation incenter integer partition integral closure integral curvature integral curves integral extension integrally closed ring integral map Karmarkar's algorithm Lanczos's method molding surface open covering open n-cell permissible value permutation matrix piecewise-continuous function pie chart Poincaré-Birkhoff fixed-point theorem propositional algebra propositional connectives

	propositional function quartic surd ramphoid cusp subdivision graph Sylow subgroup telescopic series totally imaginary field total space totitive trivial solution uniform scale
MECH mechanics	bulk rheology homogeneous strain Lanchester's rule Poinsot's central axis Poynting effect
MECH ENG mechanical engineering	avalanche protector oversteer paring parking brake
MED medicine	Kaposi's sarcoma Tourette's syndrome
MET metallurgy	cement-sand process scalping chips
MOL BIO molecular biology	closed reading frame contig homopolymer tail molecular chaperon overwinding
MYCOL mycology	nuclear plaque
NUCLEO nucleonics	direct-drive approach thimble ionization chamber
NUC PHYS nuclear physics	binding fraction exotic nucleus nuclear recoil
OPTICS optics	refracting edge
ORG CHEM organic chemistry	homolytic cleavage leuco base
PARTIC PHYS particle physics	Deck effect quark confinement
PETR petroleum engineering	biochemical rock
PHYS	covariant equation

physics	electron-positron pair rotational field telescope effect total stability Touschek effect
PHYS CHEM physical chemistry	average bond dissociation energy molecular dynamics
PHYSIO physiology	bioavailability gait analysis gestalt vision incapacitating concentration 50 lethal concentration 50 refractory period
PSYCH psychology	decompensation echopraxia symbolization
RELAT relativity	b-incomplete curve closed trapped surface four laws of black hole mechanics
STAT statistics	binomial probability paper covariance analysis open-ended class point biserial correlation coefficient quartile quartile deviation random digit unimodal union rule of probability
TEXT textiles	cowoven fabric
THERMO thermodynamics	homomorphous transformation Leslie cube Ramsay-Young method
VIROL virology	incapsidation

Table 22. Entries Deleted in Edition 5, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields:	**Entries:**
No subject field	antiroll bar antisway bar cpbs cpmc les
AERO ENG aerospace engineering	echo satellite skyraider skyray skywarrior
MATH mathematics	cover of a set union of sets
MINERAL mineralogy	wustite

Table 23. Changes in the Microstructure of Edition 5, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Types of Changes	**Changes**
A separate entry becomes one of the meanings	Ed. 4: total curvature See Gaussian curvature. Ed. 4: Total curvature of a lens [OPTICS] The difference between the reciprocals or the radii of curvature of the two surfaces of a lens. Ed. 5: Total curvature [MATH] See Gaussian curvature. [OPTICS] The difference between the reciprocals or the radii of curvature of the two surfaces of a lens.
A revised definition and a revised subject field	permissive cell Ed. 4: [MOL BIO] A cell in which viral genome replication can occur after integration of the genome into one or more chromosomes of the cell. Ed. 5: [VIROL] A cell that supports replication of a virus.
A revised definition	asphalt rock [GEOL] Ed. 4: Natural rock asphalt or asphalt-containing rock, such as porous sandstones and dolomites. Ed. 5: Natural asphalt-containing sandstone or dolomite. binomial surd [MATH] Ed. 4: a polynomial having two terms, at least one of which is a surd. Ed. 5: A sum of two roots of rational numbers, at least one of which is an irrational number. capping [MOL BIO] Ed. 4: Addition of a methyl group to the guanine nucleotide at the end of a eukaryotic messenger RNA molecule after transcription. Ed. 5: Addition of a methylated cap to eukaryotic messenger ribonucleic acid molecules. covering [MATH] (covering of a set in Ed. 4) Ed. 4: See covering of a set. Ed. 5: For a set A, a collection of sets whose union contains A. Electron probe x-ray microanalysis (Electron probe microanalysis in Ed. 4) Ed. 4: a technique in analytical chemistry in which a finely focused beam of electrons is used to excite an x-ray spectrum

	characteristic of the elements in the sample; can be used with samples as small as 10^{-11} cubic centimeter. Ed. 5: An analytical technique that uses a narrow electron beam, usually with a diameter less than 1 millimeter, focused on a solid specimen to excite and x-ray spectrum that provides qualitative and quantitative information characteristic of the elements in the sample. ghost image [ELECTR] Ed. 4: 1. An undesired duplicate image at the right of the desired image on a television receiver; due to multipath effect, wherein a reflected signal traveling over a longer path arrives slightly later than the desired signal. Ed. 5: 1. An undesired duplicate image near the desired image on a television receiver or computer display screen. greeffiellidae [INV ZOO] Ed. 4: A superfamily of free-living nematodes in the superfamily Desmoscolecoidea. Ed. 5: A family of free-living nematodes in the superfamily Desmoscolecoidea. kasha cloth [TEXT] (kasha - Ed. 4) Ed. 4: A flannel made of Tibetian goat hair slightly brushed with a crosswise streaked effect in darker hairs. Ed. 5: 1. A soft-napped fabric made from the hair fibers of Tibetian goats with a slight crosswise streaked effect. manhole [ENG] Ed. 4: An access hole to a tank or boiler, to underground passages, or in a deck or bulkhead of a ship; usually covered with a cast iron or steel plate. Ed. 5: An opening to provide access to a tank or boiler, to underground passages, or in a deck or bulkhead of a ship; usually covered with a cast iron or steel plate. myel-, myelo- [ANAT] Ed. 4: A combining form for bone marrow, spinal cord. Ed. 5: A combining form indicating relationship to marrow, often in specific reference to the spinal cord. permeameter [ENG] Ed. 4: 1. Device for measurement of the average size or surface area of small particles; consists of a powder bed of known dimension and degree of packing through which the particles are

	forced; pressure drop and rate of flow are related to particle size, and pressure drop is related to surface area. Ed. 5: 1. A laboratory device for measurement of permeability of materials, for example, soil or rocks; consists of a powder bed of known dimension and degree of packing through which the particles are forced; pressure drop and rate of flow are related to particle size, and pressure drop is related to surface area. stenoplastic [BIOL] Ed. 4: An organism which exhibits a limited capacity for modification or adaptation to a new environment. Ed. 5: Relating to an organism which exhibits a limited capacity for modification or adaptation to a new environment. triton [ASTRON] Ed. 4: One of the two satellites of the planet Neptune with a diameter of about 2880 miles (4800 kilometers). Ed. 5: The largest satellite of Neptune, with a diameter of about 1681 miles (2705 kilometers), orbiting at a mean distance of 220,500 miles (354,800 kilometers) with a period of 5 days 21.0 hours. trivial name [ORG CHEM] Ed. 4: Unsystematic nomenclature, being the name of a chemical compound derived from the names of the natural source of the compound at the time of its isolation and before anything is known about its molecular structure. Ed. 5: A common name for a chemical compound derived from the names of the natural source of the compound at the time of its isolation and before anything is known about its molecular structure.
Subject field stated	spontaneous combustion [MECH ENG]
An additional meaning in an additional subject field	base [GEN] See nitrogenous base. cover [MATH] See covering. decking [ENG] Separating explosive charges containing primers with layers of inert material to prevent passage of concussion. decomposition [MATH] The expression of a fraction as a sum of partial

	fractions. diagram [MATH] A picture in which sets are represented by symbols and mappings between these sets are represented by arrows. getter [CHEM] See scavenger. ghost [COMPUT SCI] To display a menu option in a dimmed, fuzzy typeface to indicate that this option is no longer available. land [MET] In the preparation of a pipe length for welding, the edge of the tube wall that remains perpendicular to the bore after the pipe end has been beveled. lesion [MOL BIO] A damaged site in a gene, chromosome, or protein molecule. manipulation [SCI TECH] Use of the hands in the performance of a task. microelement [IND ENG] An element of a work cycle whose time span is too short to be observed by the unaided eye. neutralize [OPTICS] To place a lens in contact with other lenses of equal and opposite power so that the combination has zero power. proprioception [PSYCH] Sensory awareness of one's location with regard to the external environment. rammer [ENG] An instrument for driving something, such as wood or stones, into another material with force. refraction [ELECTROMAG] The change in direction of lines of force of an electric or magnetic field at a boundary between media with different permittivities or permeabilities.

	scale-up [IND ENG] Transfer of a new process from a pilot plant operation to production at commercial levels. selectivity [ANALY CHEM] The ability of a type or method or instrumentation to respond to a specified substance or constituent and not to others. spontaneous combustion [CHEM] Ignition that can occur when certain materials such as tung oil are stored in bulk, resulting from the general of heat, which cannot be readily dissipated; often heat is generated by microbial action. thin film [MATER] A film of a material from one to several hundred molecules thick deposited on a solid substrate such as glass or ceramic or as a layer on a supporting liquid. tower [MATH] For a set S with a given algebraic structure, this is a set of subsets, $S_0 = S, S_1, S_2, \ldots, S_n$, such that S_{i+1} is a subset of S_i, $i = 1, 2, \ldots, n - 1$, and each S_i is closed under all possible operations in the algebraic structure of S. unit [MATH] An element of a ring with identity that has both a left inverse and a right inverse.
Several additional meanings in an additional subject field	Base [MATH] 1. A side or face upon which the altitude of a geometric configuration is thought of as being constructed. 2. For a logarithm, the number of which the logarithm is the exponent. 3. For a number system, the number whose powers determine place value. 4. For a topological space, a collection of sets, unions of which form all the open sets of the space. boom [ENG] 1. A row of joined floating timbers that extend across a river or enclose an area of water for the purpose of keeping saw logs together. 2. A temporary floating barrier launched on a body of water to contain material, for example, an oil spill. 3. A structure consisting of joined floating logs placed in a stream to retard the flow.

	drag [ENG] 1. A tool fashioned from sheet steel and having a toothed edge along the long dimension; used to level and scratch plaster to produce a key for the next coat of plaster. 2. A tool consisting of a steel plate with a finely serrated edge; dragged over the surface to dress tone. greensand [MATER] A highly siliceous sand that contains small amounts of magnesia and alumina, with about 8% of its bulk in powdered coal or charcoal; dampened with water to make foundry molds. Hallwachs effects [ELECTR] The discharge of a negatively charged metal plate caused by photoemission when the plate is exposed to ultraviolet light.
Several additional meanings in several additional subject fields	containment [ENG] An enclosed space or facility to contain and prevent the escape of hazardous material. [MOL BIO] Prevention of the replication of the products of recombinant deoxyribonucleic acid technology outside the laboratory. neutral [CHEM] Property of a solution which is neither acidic nor basic, having the same concentration of hydrogen ions as water. [MECH ENG] That setting in an automotive transmission in which all the gears are disengaged and the output shaft is disconnected from the drive wheels.
An additional meaning in an existing subject field	binder [MATER] 2. See binding agent. binding time [COMPUT SCI] 2. The instant when a variable is assigned its data type, such as integer or string. integral [MATH] 2. An element *a* of a ring *B* is said to be integral over a ring *A* contained in *B* if it is the root of a polynomial with coefficients in *A* and with leading coefficient *B*. kasha cloth (kasha - Ed. 4) [TEXT] 2. A tan, occasionally mottled, cotton flannel lining material.

	proposition [MATH] 2. A statement that makes an assertion that is either false or true or has been designated as false or true. total order [MATH] 1. The total order of an analytic function in a domain *D* is the algebraic sum of its orders at all poles and zeros in *D*.
Several additional meanings in an existing subject field	union [MATH] 2. For two fuzzy sets *A* and *B*, the fuzzy set whose membership function has a value at any element *x* that is the maximum of the values of the membership functions of *A* and *B* at *x*. 3. The union of two Boolean matrices *A* and *B*, with the same number of rows and columns, is the Boolean matrix whose element c_{ij} is row *i* and column *j* is the union of corresponding elements a_{ij} in *A* and b_{ij} in *B*.
Additional synonym(s)	amphidiploid [GEN] ... **Also known as allotetraploid.** antisense strand [MOL BIO] ... **Also known as anticoding strand.** auxocyte [BIOL] ... **Also known as gonotocont.** base [CHEM] ... **Also known as Brönsted base.** continental drift [GEOL] ... **Also known as continental displacement.** declarative statement [COMPUT SCI] ... **Also known as declarative statement.** echo check [COMPUT SCI] ... Also known as **loopback check; loop check;** read-back check. electronic typewriter [COMPUT SCI] ... **Also known as memory typewriter.** ferrimagnetism [SOLID STATE] ... **Also known as Néel ferromagnetism.** nuclear power plant

	[MECH ENG] ... **Also known as atomic power plant.** permeability [ELECTROMAG] ... **Also known as magnetic permeability.** spondylitis [MED] ... **Also known as ankylosing spondylitis.**
An additional illustration	total radiation pyrometer [ENG]
Reference to another article instead of definition	continental shield Ed. 4: [GEOL] Large areas of Precambrian rocks exposed within the cratons of continents. Ed. 5: See shield. homolysis Ed. 4: [CHEM] Symmetrical breaking of a covalent electron bond; for example, A:B = A + B. Ed. 5: See homolytic cleavage. manic-depressive illness (manic-depressive psychosis in Ed. 4) Ed. 4: [PSYCH] A severe disturbance of affect characterized by extreme and pathological elation alternating with severe dejection, both of which may last for months or years. Ed. 5: See bipolar disorder. man-machine chart Ed. 4: [IND ENG] A two-column, multiple-activity process chart listing the steps performed by an operator and the operations performed by a machine and showing the corresponding idle times for each. Ed. 5: See human-machine chart. man-machine system Ed. 4: [ENG] A system in which the functions of the worker and the machine are interrelated and necessary for the operation of the system. Ed. 5: See human-machine system. spontaneous ignition Ed. 4: [CHEM] Ignition which can occur when certain materials such as tung oil are stored in bulk, resulting from the generation of heat, which cannot be readily dissipated; often heat is generated by microbial action. Ed. 5: See spontaneous combustion.
One definition	base

deleted	[ELECTR] 4. A plastic film that supports the magnetic powder of magnetic tape or the emulsion of photographic film. - del.
Part of the definition deleted	base [CHEM] Any chemical species, ionic or molecular, capable of accepting or receiving a proton (hydrogen ion) from another substance; the other substance acts as an acid in giving of the proton (; the hydroxyl ion is a base - del.).
Part of the illustration description deleted	aspidorhynchiformes [PALEON] Ed. 4: *Aspidorhynchus acutirostris* (Blainville), Upper Jurassic, Bavaria, length to 3 feet (91 centimeters); a typical fish of the order aspidorhynchiformes (*after Assmann*) Ed. 5: *Aspidorhynchus acutirostris* (Blainville), Upper Jurassic, Bavaria, length to 3 feet (91 centimeters). Galatheidea [INV ZOO] Ed. 4: *Munida evermanni (Smithsonian Institution).* Ed. 5: *Munida evermanni*. gibbon [VERT ZOO] Ed. 4: *Hylobates lar*, which is a typical gibbon with extremely long arms and opposite thumb and big toe, and is found in Sumatra and southern Asia. Ed. 5: *Hylobates lar*, which is a typical gibbon. lampridiformes [VERT ZOO] Ed. 4: Oarfish (*Regalecus glesne*); an example of Lampridiformes; length to over 20 feet (6 meters). (*After D. S. Jordan and B. W. Evermann, The Fishes of North and Middle America, U.S. Nat. Mus. Bull. no 47, 1900*) Ed. 5: Oarfish (*Regalecus glesne*); length to over 20 feet (6 meters). leucaltidae [INV ZOO] Ed. 4: *Leucaltis clathria* showing the small chambers. (*After Polejaeff, 1883*) Ed. 5: *Leucaltis clathria* showing the small chambers. mole [VERT ZOO] Ed. 4: The European common mole, with thick black fur, a reduced tail, and spadelike forelimbs. Ed. 5: The European common mole. open caisson [CIV ENG] Ed. 4: Underside of open caisson for Greater New Orleans bridge over Mississippi River. Note prefabricated steel cutting

	edge. (*Dravo Corp.*) Ed. 5: Underside of open caisson for Greater New Orleans bridge over Mississippi River. (*Dravo Corp.*) spongocoel [INV ZOO] Ed. 4: Morphology of asconoid calcareous sponge - longitudinal section. (*After Hyman, 1940*) Ed. 5: Morphology of asconoid calcareous sponge - longitudinal section. syllidae [INV ZOO] Ed. 4: *Exogone*, of the Syllidae (Exogoninae), dorsal view showing cirri and ova attached to body segments. Ed. 5: *Exogone*, of the Syllidae (Exogoninae), dorsal view unipotential electrostatics lens [ELECTR] Ed. 4: A unipotential electrostatic lens, a type of axially symmetric electrostatic lens. ϕ_0 = common potential for outer two apertures; ϕ_1 = lower potential for central aperture. (*From E. G. Ramberg and G. A. Morton, J. Appl. Phys., vol. 10, 1939, and V. K. Zworykin et al., Electron Optics and the Electron Microscope, Wiley 1945*) Ed. 5: A unipotential electrostatic lens, a type of axially symmetric electrostatic lens. ϕ_0 = common potential for outer two apertures; ϕ_1 = lower potential for central aperture.
An illustration deleted	airspeed indicator [ENG] air-suspension system [MECH ENG] air-to-ground missile [ORG] chloralase [ORG CHEM] chlorendic anhydride [ORG CHEM] chlorine [CHEM] covellite [MINERAL] lynx [VERT ZOO] microcline [MINERAL] mycorrhiza [BOT]

	podophyllotoxin [PHARM] praseodymium [CHEM] propyl gallate [ORG CHEM] quartz [MINERAL] scandium [CHEM] selenium [CHEM] spodumene [MINERAL] teleterminal [COMPUT SCI] Tourmaline [MINERAL]
Altered order of definitions	neutral point [OPTICS] In atmospheric optics, one of several points in the sky for which the degree of polarization of diffuse sky radiation is zero. [PHYS] A point where two fields are equal in magnitude and opposite in direction so that the net field is zero.
Altered order of synonyms	kasugamycin [MICROBIO] ... Also known as kasugamycin hydrochloride; kasumin.

Table 24. New Entries in Edition 6, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields	**Entries**
No subject field	air toxics antisecant antisine antitangent celp coder context switching cowpea mosaic virus group declarative memory directed cycle directed system exoplanet GFP Ghirardi-Rimini-Weber-Pearle theory green design Green's theorem in space LES LMSS microchip molecular fossils podzolic soil PPP proppant RFQ scanning near-field optical microscopy shoemaker's knife spongiform encephalopathy symbolic computation system totally ordered set TRMM uniform structure unique-factorization ring WWW wye connection
AERO ENG aerospace engineering	Hall plasma thruster
ASTRON astronomy	exozodiacal dust giant branch open inflation Prospero ram pressure stripping

	Stephano Sycorax thin disk Trojan asteroid
ATOM PHYS atomic physics	exotic atom Landé Γ-permanence rule
BIOCHEM biochemistry	amphiphilic biochemical biochemical engineering C-peptide galactosyl ceramide somatomedin
BIOL biology	bioactivity
BIOPHYS biophysics	biocalorimetry molecular biophysics
BOT botany	ramiform
CELL MOLL cell and molecular biology	antiporter exocellular green fluorescent protein integral membrane protein nuclear receptor superfamily uniporter
CHEM chemistry	exocyclic green chemistry meitnerium molecular device
COMMUN communications	in-band/adjacent-channel in-band/on-channel land-earth station
COMP SCI computer science	avatar boot record boot virus bulletin board system common gateway interface common object request broker context switch CPU fan declarative language declarative markup language drag and drop open-bus system Practical Extraction and Reporting Language Rambus dynamic random-access memory

	symbolic computing symbolic system Trojan horse uniform resource locator
CONT SYS control systems	direct expert control system
ECOL ecology	courtship microfauna trophic ecology
ELECTR electronics	homojunction bipolar transistor integrated-circuit filter quantum well infrared photodetector quantum well injection transit-time diode unimorph
ELECTROMAG electromagnetism	four-limbered core
EMBRYO embryology	totipotent cell
ENG engineering	bulk micromachining Hall-plate device microelectrode micro-electro-mechanical system + ill microengineering microfabrication telethesis
ENG ACOUS engineering acoustics	Leslie effect verbal information verification
EVOL evolution	Permo-Triassic mass extinction
FL MECH fluid mechanics	Landau-Levich-Derjaguin picture ram pressure shock cells total wetting
FOOD ENG food engineering	bulgur ghee
GEN genetics	contiguous gene syndrome homogeneously staining region homolog homologous chromosomes homologous recombination inbred strain somatic mutation uniparental disomy
GEOPHYS geophysics	echosonde

GRAPHICS graphic arts	antiskinning agents
HISTOL histology	myeloid cell
IMMUNOL immunology	prostate specific antigen
IND ENG industrial engineering	Pareto diagram
INV ZOO invertebrate zoology	green muscardine
MAR ENG marine engineering	podded propulsion + ill
MATER materials	bioceramic green forming microemulsion
MATH mathematics	antisymmetric determinant binormal indicatrix closed circular region closed dipath closed disk closed half plane closed half space closed-mapping theorem closed path closed polygonal region closed pyramidal surface closed rectangular region closed region closed triangular region common factor common tangent decomino diagonal latin square directed network directed path exotic four-space exotic sphere expanded notation expanded numeral four-group homothetic center incidence function integrable differential equation integrable function open circular region

	open half plane open half space permutation character piecewise-smooth curve quartic quantic Ramsey number Ramsey property Ramsey theorem Ramsey theory rotation angle slant height trivial graph trivial topology tromino uniform topology unilateral shift unimodal sequence unique-factorization domain unital left module unital module
MECH mechanics	integrable system
MECH ENG mechanical engineering	continuous-type furnace
MED medicine	antisense drug asphyxation bioartificial organs biochemical pharmacology exotic viral disease hemodialysis molecular biomarker mycosis fungoides mycotoxicosis overt infection Parinaud's oculoglandular syndrome Prader-Willi syndrome spondyloarthropathy subcutaneous mycosis water brash
METEOROL meteorology	bull-eye squall greenhouse gases
MICROBIO microbiology	diagnostic bacteriology lysogen Thiobacillus ferrooxidans
MINERAL	wustite

mineralogy	
MOL BIO molecular biology	antisense ribonucleic acid
MYCOL mycology	gibberella fugikuroi Letinula edodes mycorrhizal fungi Mycosphaerella sentina Podosphaera leucotricha Venturia inaequalis
NAV navigation	total system error
NAV ARCH naval architecture	integrated electric propulsion
OCEANOGR oceanography	hemipelagite total allowable catch
OPTICS optics	integral photography + ill. microdisk laser
ORG CHEM organic chemistry	thimerosal
PHYS physics	scale symmetry totally stable system
PHYSIO physiology	step-down photophobic response
PSYCH psychology	binge eating disorder proprioceptive defect prosopagnosia somatization disorder somatoform disorder veridicality
QUANT MECH quantum mechanics	antisymmetrized wave function decoherence quantum theory of matter quantum theory of measurement
STAT statistics	binomial random variable
SOLID STATE solid-state physics	giant magnetoresistance
SYS ENG systems engineering	total quality management
VERT ZOO vertebrate zoology	aspidospondyly
VIROL virology	Lyssavirus nuclear polyhedrosis virus Podoviridae Poxviridae

Table 25. Entries Deleted in Edition 6, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Subject Fields	**Entries**
No subject field	content-addressed storage
ASTRON astronomy	Trojan planet
COMMUN communications	dial telegraph neutral transmission teleprinter code teletypewriter test tape
COMPUT SCI computer science	available machine time overpunch symbolic deck
GEN genetics	lyon phenomenon amphiploid
MED medicine	homologous serum jaundice
PARTIC PHYS particle physics	l meson
SPECT spectroscopy	raman spectrophotometry

Table 26. Changes in the Microstructure of Edition 6, *McGraw-Hill Dictionary of Scientific and Technical Terms*.

Types of Changes	**Changes**
A revised definition and a revised subject field	karyotype Ed. 5: [CYTOL] The normal diploid or haploid complement of chromosomes, with respect to size, form, and number, characteristic of an individual, species, genus, or other grouping. Ed. 6: [CELL MOL] 1. The compliment of chromosomes characteristic of an individual, species, genus, or other grouping. 2. An organized array of the chromosomes from a single cell, grouped according to size, centromere position, and banding pattern, if any. microcomputer Ed. 5: [ELECTR] A microprocessor combines with input/output devices, some type of external memory, and the other elements required to form a working computer system; it is smaller, lower in cost, and usually slower than a minicomputer. Ed. 6: [COMPUT SCI] 1. A digital computer whose central processing unit resides on a single semiconductor integrated circuit chip, a microprocessor. 2. An electronic device, typically consisting of a microprocessor central processing unit, semiconductor memory (RAM), graphics display, and keyboard. typical configurations also include a hard disk for persistent memory, a compact disk drive, a disk drive which allows removable disks to be used to move data in and out of the machine, and a pointing device. molecular electronics Ed. 5: [ELECTR] The systematic use of molecular materials to produce new or improved electronic devices. Ed. 6: [COMPUT SCI] The use of biological or organic molecules for fabricating electronic materials with novel electronic, optical, or magnetic properties; applications include polymer light-emitting diodes, conductive-polymer sensors, pyroelectric plastics, and, potentially, molecular computational devices.
A revised definition	amphidiploid [GEN] Ed. 5: An organism having a diploid set of chromosomes from each parent. Ed.6: A tetraploid organism or species produced when chromosomes of a hybrid between two species double, yielding a

	diploid set of chromosomes from each parent. antiserum [IMMUNOL] Ed. 5: Any immune serum that contains antibodies active chiefly in destroying a specific infecting virus or bacterium. Ed.6: The serum component of blood that contains antibodies specific to one or more antigens. baseband [COMMUN] Ed. 5: The band of frequencies occupied by all transmitted signals used to modulate the radio wave that is produced by the transmitter in the absence of the signals. Ed. 6: The band of frequencies occupied by all transmitted signals used to modulate the radio wave. exon [GEN] Ed. 5: That portion of deoxyribonucleic acid which codes for the final messenger ribonucleic acid. Ed. 6: The segment or segments of a gene which code for its final messenger ribonucleic acid. exon shuffling [GEN] Ed. 5: In eukaryotic split genes, the creation of new genes by the recombination of exons through crossing over. Ed. 6: In eukaryotic split genes, the creation of new genes by the addition or removal of exons through unequal crossing over within intros intervening between the exons of a split gene. hemizygous [GEN] Ed. 5: Pertaining to the condition or state of having a gene present in a single doze; for instance, in the X chromosome of male mammals. Ed. 6: In diploid organisms. the presence of a single copy of a gene; it may be a result of deletion or chromosome loss, or simply may reflect the presence of a single copy of a sex chromosome, such as the X in male mammals. inbreeding [GEN] Ed. 5: Breeding of closely related individuals; self-fertilization,

	as in some plants, is the most extreme form. Ed. 6: Reproduction behavior between closely related individuals; self-fertilization, as in some plants, is the most extreme form. island arc [GEOGR] Ed. 5: A group of islands usually with a curving archlike pattern, generally convex toward the open ocean, having a deep trench or trough on the convex side and usually enclosing a deep basin on the conclave side. Ed. 6: A group of volcanic islands, usually situated in a curving arch-like pattern that is convex toward the open ocean, having a deep trench or trough on the convex side and usually enclosing a deep basin on the conclave side; formed by volcanic activity associated with oceanic plate subduction at convergent plate margins. isoallele [GEN] Ed. 5: An allele that carries mutational alterations at the same site. Ed. 6: An allele whose phenotype is indistinguishable from that of a different mutant allele at the same locus. kaolinite [MINERAL] Ed. 5: The principal minearl of the kaolin group of clay minerals; a white, gray, or yellowish high-alumina nimeral consisting of sheets of tetrahedrally coordinated silicon linked by an oxygen shared with octahedrally coordinated aluminum. Ed. 6: A common hydrous aluminum silicate mineral found in sediments, soils, hydrothermal deposits, and sedimentary rocks. It is a member of the kaolin group of minerals, which include dickite, halloysite, nacrite, ordered kaolinite, and disordered kaolinite. lyon hypothesis [GEN] Ed. 5: The concept that mammalian females are X-chromosome mosaics as a result of the inactivation of one X chromosome in some embryonic cells and the the other in the rest. Ed. 6: The concept that mammalian females are X-chromosome mosaics as a result of the random inactivation of one X chromosome in some embryonic cells and their descendants and

	of the other X chromosome in the rest. meiotic drive [GEN] Ed. 5: Any meiotic deviation from Mendelian segregation ration in heterozygotes resulting from a disturbance in the meiotic mechanism. Ed. 6: Preferential meiotic segregation favoring one chromosome over its homologue. propping agent [PETRO ENG] Ed. 5: A granular substance, for example, sand grains or walnut shells, suspended in the drilling fluid during the fracturing portion of the drilling operation to keep the fracture open when the fluid is withdrawn. Ed. 6: Sand, gravel, or particles of other material (such as sintered bauxite or ceramic beads) suspended in drilling fluid during formation fracturing to keep (prop) open the cracks in the rock when the fluid is withdrawn. stencil [GRAPHICS] Ed. 5: A means of applying a pattern with ink or paint; the stencil itself is cut from thin metal or cardboard sheet, and the paint or ink is brushed or sprayed into the open areas. Ed. 6: 1. A template with either mechanically or hand cut openings. 2. A metal foil with openings made by chemically etching, laser cutting, or electroforming processes. venus [ASTRON] Ed. 5: The planet second in distance from the sun; the linear diameter, about 7500 miles (12,200 kilometers), includes the top of a cloud layer; the diameter of the solid globe is about 30 miles (50 kilometers) less; the mass is about 0.815 (earth = 1). Ed. 6: The planet second in distance from the sun; the linear equatorial diameter of the solid globe is 7521 miles (12,104 kilometers); the mass is about 0.815 (earth = 1).
An altered illustration	manned spacecraft [AERO ENG] photo to scheme picture tube [ELECTR] A better scheme

	telephone transmitter [ENG ACOUS] A new illustration and description Ed. 5: Cut-away view of telephone transmitter of the direct-action granular-carbon type. Sound pressure on diaphragm varies pressure of dome-shaped electrode on the carbon, causing changes in resistance of the carbon granules, and, in turn, in the magnitude of the current. Ed. 6: Cross section of an electret telephone transmitter.
Altered illustration description	molecular distillation [CHEM] Ed. 5: Schematic diagram illustrating distillation at molecular distillation conditions. Ed. 6: Schematic diagram of process.
An additional meaning in an additional subject field	cementum [MED] A tissue closely resembling bone which covers the root of a tooth. contig [GEN] A region of chromosome defined by its hybridization to one or more clones deoxyribonucleic acid fragments from an overlapping array of clones. continuity [NAV] The ability of a navigational system to let the usher navigate without interruption. drag [COMPUT SCI] To move an object across a screen by moving a pointing device while holding down the control button. nucleation [PHYS CHEM] The formation of vapor bubbles in a superheated liquid. reversion [MATH] For a series, the process of constructing a new series in which the dependent and independent variables of the original series are interchanged. scaling [MED] See root planning.
Several additional meanings in an additional subject field	loading [FL MECH] 1. The relative concentration of particles in a flowing fluid. 2. In particular, the ration of particle mass flow to fluid mass flow.
Several additional	availability

meanings in several additional subject fields	[NAV] The probability that a navigational system will function and provide required levels of accuracy, integrity, and continuity. [SYS ENG] The probability that a system is operating satisfactorily at any point in time, excluding times when the system if under repair.
An additional meaning in an existing subject field	bullet [GRAPHICS] 2. A circle or other graphical character, about the height of a lowercase letter, used to set off items in a list. cover [MATH] 1. An element, *x*, of a partially ordered set covers another element *y* if *x* is greater than *y*, and the only elements that are both greater than or equal to *y* and less than or equal to *x* are *x* and *y* themselves. decomposition [MATH] 2. The representation of a set as the union of pairwise disjoint subsets. land [ELECTR] 1. One of the regions between pits on a track on an optical disk. point at infinity [MATH] 1. A single point that is adjoined to the complex plane so that it corresponds to the pole of a stereographic projection of the Riemann sphere onto the complex plane, giving the complex plane a compact topology. union [MATH] 4. The union of two graphs is the graph whose set of vertices is the union of the sets of vertices of the two graphs, and whose set of edges is the union of the sets of edges of the two graphs.
Additional information in the definition	antiseptic A substance used to destroy or prevent the growth of infectious microorganisms on or in the **human or animal** body. propositional function [MATH] An expression that becomes a proposition when the values of certain symbols in the expression are specified, **and that is either true or false depending on these values.** raman spectroscopy

	[SPECT] Analysis of the intensity of Raman scattering of monochromatic light as a function of frequency of the scattered light; **the information obtained is useful for determining molecular structure.** spontaneous mutation [GEN] A mutation that occurs spontaneously, **that is, in an individual not specifically exposed to a known mutagen.** thin-film transistor [ELECTR] A field-effect transistor constructed entirely by thin-film techniques, for use in thin-film circuits. **Abbreviated TFT.**
Additional synonym(s)	binomial trials [STAT] ... Also known as **Bernoulli experiments**; ... Cenozoic [GEOL] ... **Also known as Cainozoic.** common fraction [MATH] ... **Also known as simple fraction; vulgar fraction** directed set [MATH] ... **Also known as directed system; Moore-Smith set.** dragging of internal frames [RELAT] ... Also known as **frame dragging,** Lense-Thirring effect. eclipse year [ASTRON] ... **Also known as draconic year; nodical year.** ferroelectric [SOLID STATE] ... Also known as **Rochelle electric;** ... Halley's Comet [ASTRON] ... **Also known as Comet Halley.** homothetic figures [MATH] ... **Also known as radially related figures.** propositional function [MATH] ... Also known as **logical function; open sentence; open statement;** predicate**; sentential function; statement function.**

	propping agent [PETRO ENG] ... **Also known as proppant.**
An additional illustration	exotic atom [ATOM PHYS], but was also a new term integral photography [OPTICS], but was also a new term microchannel plate [ELECTR] micro-electro-mechanical system [ENG], but also a new term podded propulsion [MAR ENG], but also a new term quantum well [ELECTR] Trojan asteroid [ASTRON], but also a new term unimorph [ELECTR], but also a new term
Definition instead of reference to another article	echolocation [BIOPHYS] Ed. 5: See echo ranging. Ed. 6: An animal's use of sound reflections to localize objects and to orient in the environment. stencil printing [GRAPHICS] Ed. 5: See screen printing. Ed. 6: A method of transferring a pattern by brushing, spraying, or squeeging ink or pattern through the open areas of a stencil cut from thin metal or cardboard. Also known as pochoir. unitary space [MATH] Ed. 5: See inner product space. Ed. 6: A finite-dimensional inner-product space over the field of complex numbers.
One definition deleted	flavin [BIOCHEM] 1. A yellow dye obtained from the bark of quercitron trees. - del. subchannel [COMMUN] IN a telemetry system, the route required to convey the magnitude of a single subcommutated measurand. teleprinter [COMMUN] A device that respond to teletype signals and prints the corresponding characters on paper type.
Part of the definition deleted	teleprinting [COMMUN] Telegraphy in which the transmitter and receiver are (teleprinters or - del.) teletypewriters.

Part of the illustration description deleted	hylidae [VERT ZOO] North American tree frogs. - del. Green tree grog, *Hyla cinera* (left) and gray tree frog, *H. versicolor* (right). (*American Museum of Natural History photograph*)
A synonym deleted	echo ranging [ENG] Active sonar, in which underwater sound equipment generates bursts of ultrasonic sound and pick up echoes reflected from submarines, fish, and other objects within range, to determine both direction and distance to each target. Also known as echo location. - del.
An illustration deleted	communications satellite [AERO ENG] flat-belt pulley [DES ENG] integrated circuit [ELECTR] open caisson [CIV ENG] permeameter [ENG] power supply [ELECTR] Trojan planet [ASTRON], but the term was deleted as well unijunction transistor [ELECTR]
Altered order of definitions	scanner [COMMUN] That part of a facsimile transmitter which systematically translates the densities of the elemental areas of the subject copy into corresponding electric signals. [COMPUT SCI] A device that converts an image of something outside a computer, such as text, a drawing, or a photograph into a digital image that it sends into the computer for display or further processing.