AtoZ
novas práticas em informação e conhecimento

ISSN: 2237-826X
PAPER | ARTIGO | ARTÍCULO

Boolean logic applied to the construction of search expressions

Lógica booleana aplicada na construção de expressões de busca

Antonio Carlos Picalho[1], Elaine Rosangela de Oliveira Lucas[2], Igor Soares Amorim[3]

[1] *University of Santa Catarina (UFSC), Florianópolis, SC, Brazil. ORCID: https://orcid.org/0000-0002-6520-6224*

[2] *State University of Santa Catarina (UDESC), Florianópolis, SC, Brazil. ORCID: https://orcid.org/0000-0002-2796-3566*

[3] *State University of Santa Catarina (UDESC), Florianópolis, SC, Brazil. ORCID: https://orcid.org/0000-0003-2606-6000*

Mail to/*Autor para correspondência/Correo a:* Antonio Carlos Picalho, tonipicalho@gmail.com

Submitted/*Recibido*: 8 de julho de 2021; **Approved/*Aceptado***: 12 de outubro de 2021

Copyright © 2022 Picalho, Lucas & Amorim. All the journal content (including instructions, editorial policies and templates) - except where otherwise indicated - is under a Creative Commons Attribution 4.0 International, since October 2020. When published by this journal, articles are free to share, adapt and you must give appropriate credit, provide a link to the license, and indicate if changes were made. To further information check http://revistas.ufpr.br/atoz/about/submissions#copyrightNotice.

Abstract
Introduction: Searching the web is an activity that does not require much effort considering how easy it is to type search expressions in search boxes of search engines and scientific databases. However, due to the continuous growth in the volume of information on the web, it is necessary to develop skills that help the research assertiveness. The use of Boolean operators are examples of this. The study aimed to describe different ways of operation of Boolean operators in search expressions. **Method:** The applications were represented in the form of Venn Diagrams and the research examples cover different topics. **Results:** Based on the visualization of the diagrams, demonstrations of the use of Boolean operators were described and associated with elements of classical logic. **Conclusions:** In the end, it is understood that classical logic underlies the search strategies that reflect on the way Boolean operators are used and through logical reasoning, it is necessary to analyze case-by-case during the formulation of the search strategy to be followed.

Keywords: Boolean operators; Logic; Search expressions; Boolean algebra; Aristotle.

Resumo
Introdução: *Pesquisar na web é uma atividade que não requer grande esforço se considerarmos a facilidade em digitar expressões de busca em caixas de pesquisa de buscadores e bases de dados científicas. Contudo, devido ao crescimento contínuo no volume de informações na web, é necessário desenvolver habilidades que auxiliem a assertividade da pesquisa. O uso de operadores booleanos são exemplos disso. O estudo aqui apresentado teve por objetivo descrever diferentes maneiras de funcionamento dos operadores booleanos em expressões de busca.* ***Método:*** *São apresentados exemplos com aplicações representadas na forma de Diagramas de Venn e os exemplos de pesquisa abrangem diferentes temáticas.* ***Resultados:*** *Com base na visualização dos diagramas, as demonstrações de uso dos operadores booleanos foram descritas e associadas a elementos da lógica clássica.* ***Conclusão:*** *Ao final, compreende-se que a lógica clássica fundamenta as estratégias de pesquisa que se refletem na forma de uso dos operadores booleanos e, por meio do raciocínio lógico, é preciso analisar caso a caso durante a formulação da estratégia de busca a ser seguida.*

Palavras-chave: *Operadores booleanos; Lógica; Expressões de busca; Álgebra booleana; Aristóteles.*

INTRODUCTION

Seeking information is an indispensable endeavor for those who aim to acquire new knowledge. When conducting research, whether of a scientific nature or not, it is essential to gather information from documents, select high-quality materials, read, interpret, and then build upon existing knowledge.

While the advent of the internet has expanded the horizons of research, the volume of information produced continues to increase incessantly. In the present landscape, where vast amounts of information, primarily on the web, are readily available, it becomes crucial to develop skills that allow us to effectively combine sound research methods and techniques with the technological resources that facilitate the retrieval of necessary information. Only through this approach can we accurately locate high-quality documents to support our research.

One of the methods employed to create more robust and precise search expressions is the use of Boolean operators. This research explores how these operators operate and their relevance in search expressions. It provides examples of their application and underscores the connection with Aristotelian thought as a pivotal factor in constructing these expressions. The process of retrieving and selecting bibliographic and documentary sources is paramount in scientific research. This applies whether one is conducting literature reviews, establishing theoretical frameworks, or consolidating results and discussions. Given this backdrop, the study presented here is of significance, as it not only compiles strategies for retrieving content for scientific research within the framework of Boolean logic but also serves as a guide for students and researchers seeking to enhance their search strategies on databases and other search engines. This is achieved through a deeper understanding of the use of Boolean operators when applicable. The study's objective is to describe various applications of Boolean operators in search expressions. It is characterized as applied research, with a qualitative approach to the principal subject of the study. Descriptive examples of the operators are presented and applied to different thematic areas.

Concerning the procedures followed, and to gain a better comprehension of the topic, search techniques utilizing Boolean operators are described based on the logical research presented in this work, reminiscent of the logic that emanates from Aristotelian thought.

Boolean operators and their various applications are described in search expressions related to different thematic possibilities for research. They are visually represented through Venn diagrams, accompanied by a logical description of the operations involved.

The text's structure commences by introducing the concept of logic and identifying the logical aspects that impact the quality of search strategies. Subsequently, it delves into Boolean logic and its implications in information retrieval. Finally, it elucidates the crucial principles in crafting search expressions for search systems commonly available on the internet.

LOGIC AND RESEARCH STRATEGIES

Defined by Mortari (2001, p. 2) as "the science that studies principles and methods of inference, with the main objective of determining under which conditions certain things follow (are consequences) or not from others," logic seeks to explain the processes and results of reasoning based on the information available at the time.

Logic, as an instrument for acquiring knowledge, originated with Aristotle (384-322 BC). The philosopher drew from the ideas of the sophists and built upon Plato's dialectic, transforming it into a robust system. Aristotle aimed to acquire knowledge about something without falling into contradictions by basing it on the application of reality as true or false (Chaui, 2000).

Aristotle's theory of argumentation recognized two distinct types of arguments used to validate ideas, namely deduction and induction (Smith, 2009). Deductions involve **valid arguments that move from the general to the specific** and are considered correct only if all premises are true.

All men are mortal

Socrates is a man

Therefore, Socrates is mortal

Inductions, on the other hand, are **arguments that move from the specific to the universal**. They rely on probability and generalization to formulate rules and establish facts.

Socrates has two legs

Plato has two legs

Aristotle has two legs

Socrates, Plato, and Aristotle are humans

Therefore, all humans have two legs

Ancient philosophers in ancient Greece began to use affirmative and negative statements, resulting in significant simplification and clarity, which were perpetuated in mathematics and, over time, expanded to various fields of knowledge through the work of different researchers (Daghlian, 1995; Pereira, 2012; Smith, 2017).

In addition to classical logic, some 20th-century studies sought solutions to logical questions beyond the known Aristotelian logic, paving the way for what became known as non-classical logics (D'Ottaviano & Feitosa, 2009).

For clarification, classical logic and non-classical logics can complement or oppose the principles presented by the classical model, according to Haack (1974). The main differences lie in the fact that non-classical logics allow for more diverse forms of expression, may have entirely different principles or just a distinct semantics, while classical logic focuses on basic logical connectives: negation, conjunction, and disjunction. This research, therefore, is grounded in classical logic (D'Ottaviano & Feitosa, 2009).

In the field of Information Science, particularly in information retrieval, the logic behind the mechanisms of database systems integrates principles derived from the logical schematization of George Boole's algebra (1815-1864) and George Cantor's Set Theory (1845-1918), both rooted in Aristotelian thought.

When conducting a search in a scientific database, the user's expectation is to successfully retrieve relevant information sources that align with their research objectives.

Focusing on the logic employed by users when conducting a search, Rowley and Lemos (2002, p. 172) states:

> "Logic is used to link terms that describe the concepts within the search statement. [...] Search logic allows for the inclusion of synonyms and related terms in the search statement, as well as specifying acceptable and unacceptable combinations of search terms. [...] The person conducting the search specifies a search statement, and the computer responds by indicating the number of relevant records. With this type of search resource, the strategy can be refined to achieve a satisfactory outcome."

As a result, users expect to obtain a response that meets their information demands by retrieving documents relevant to their research objectives. Success in this process within a scientific database is closely tied to the search logic upon which the user relies when constructing their search strategy.

Using specific combinations of terms available in the information retrieval system, users employ search logic. Among the various search operators utilized, most systems employ Boolean search logic (Rowley & Lemos, 2002, p. 171-172).

Users establish and formulate their search expressions based on a strategy they define, relying on the logic used by information retrieval systems. A well-defined strategy is one of the key resources for achieving success when searching databases.

According to Chartier (2003, p. 153), "strategies imply places and institutions, produce objects, norms, models, accumulate, and capitalize." At the same time, when lacking a specific place or control over time, strategies become "ways of doing," or rather, ways "of doing in spite of." In this context, during the process of searching scientific databases, users, while inside the system, schematize search processes, generate results, and thereby employ research strategies. However, when encountering obstacles, whether operational or related to technological limitations, users must employ tactics that are more related to resourcefulness in the face of adversity, echoing Chartier's description as "ways 'of doing in spite of'" Chartier (2003, p. 153-154).

Moving closer to concepts within the field of Information Science, Goulart and Junior (2007, p. 56) understand the research strategies employed by users as "a plan involving a series of actions to find information." It is crucial for users to recognize that a single research strategy may not always suffice to achieve the intended results. In their studies, the authors also indicate that "users tend to employ two or three different strategies in their searches, as the act of searching can lead researchers in different directions, depending on the links activated and the pages visited at each stage of the search." Having a well-defined strategy makes it easier for users to revisit it and employ new tactics to refine it before trying again.

A good understanding of the search logic on which the chosen scientific database or search engine relies enables users to plan a research strategy that ensures the retrieval of relevant documents, guaranteeing effectiveness in the entire process.

BOOLEAN ALGEBRA AND ITS LOGICAL OPERATORS

Rooted in the realm of Aristotelian logic, Boolean algebra comprises a logical, binary, and bivalent system devised by the mathematician George Boole in the mid-19th century. In his work titled "*The Mathematical Analysis of Logic*," Boole established the "rules of a symbolic system for mathematics," thereby contributing to a formal understanding of logic as primarily a calculus (Moreira, 2007).

Algebraic reasoning relies on symbols, classified based on their functions, to bridge the gap between analog and algebraic symbols, ultimately forming a calculus (Moreira, 2007). Each Boolean variable can adopt one of two values—0 or 1—representing 'true' and 'false,' respectively. These values are synonymous with 'off' and 'on,' among other interpretations, which may vary according to the specific context in which they are employed.

Remarkably, after a century of lacking practical and successful applications, Claude Elwood Shannon, in his 1938 master's thesis at the *Massachusetts Institute of Technology's* Department of Electrical Engineering, demonstrated the utility of Boolean Algebra in analyzing relay circuits [...]. This groundbreaking development laid the foundation for switch theory (Daghlian, 1995, p. 18). The theory establishes relationships based on Boole's concepts, revealing that it is possible to address problems with just two possible outcomes: the binary variables 'true' or 'false.'

Derived from set theory and nestled within the field of Information Science, particularly in the domain of information retrieval, Boolean operators play a crucial role in scientific databases and other search engines by providing a logical framework for search queries and ensuring precise results.

Fundamentally, constructing a search using Boolean operators involves either combining two distinct terms mandatorily (AND), allowing for an eligible combination (OR), or excluding one or more terms (NOT). These operators are invaluable as they serve as connectors between the terms used in the search query, thereby facilitating enhanced precision or broader results.

Databases and various search engines, which facilitate the use of Boolean algebra operations, frequently implement these features using terms such as 'AND' (signifying the intersection of two or more terms), 'OR' (indicating the union of two or more terms), and 'NOT' (sometimes 'AND NOT') — a clear indication that certain terms should be excluded from the search results.

USAGE DEMONSTRATIONS IN SEARCH STRATEGIES

Figures 1, 2, and 3, presented below, employ Venn Diagrams to illustrate how searches are conducted in a database using Boolean operators. The dashed area in the images represents the documents retrieved when each of the Boolean operators is applied.

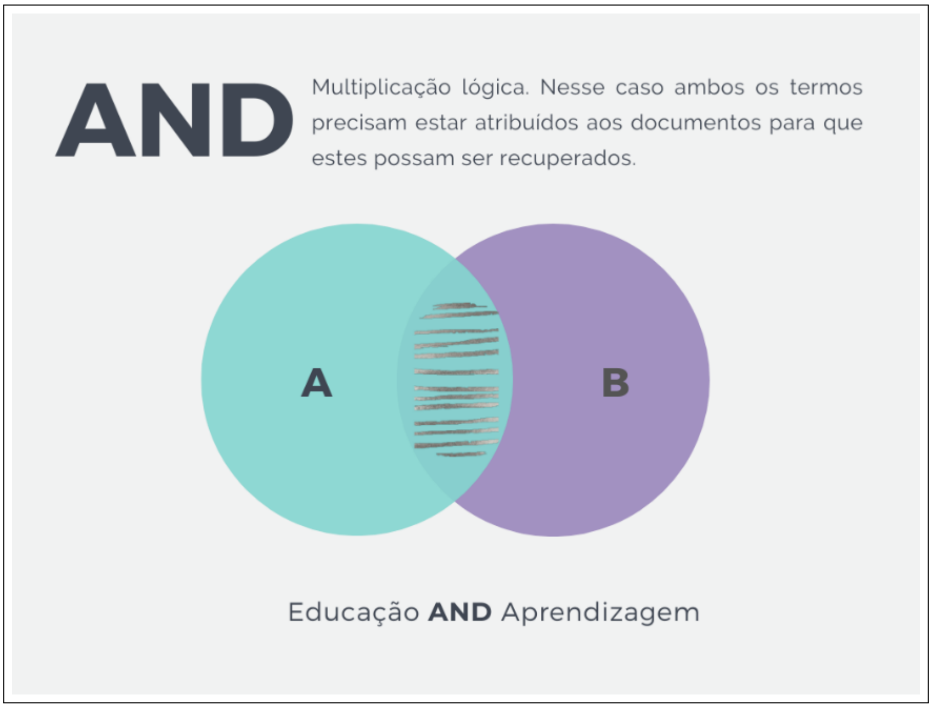

Figure 1. Use of the Boolean Operator AND

In the case of Figure 1, the term "Education," represented in the Venn Diagram as (A), and the term "Learning," represented as (B), are used in conjunction with the Boolean operator AND, indicating that both terms must appear in the retrieved documents. The user, when performing this search, will obtain results from documents that necessarily address both Education and Learning in the same document.

Figure 2. Use of the Boolean Operator OR

In Figure 2, the terms "Teacher" (A) and "Instructor" (B) are considered equivalent and are typically used when it is important to retrieve documents containing at least one of them. The use of the Boolean operator OR instructs the system to return documents containing at least one of the terms stated in the search query.

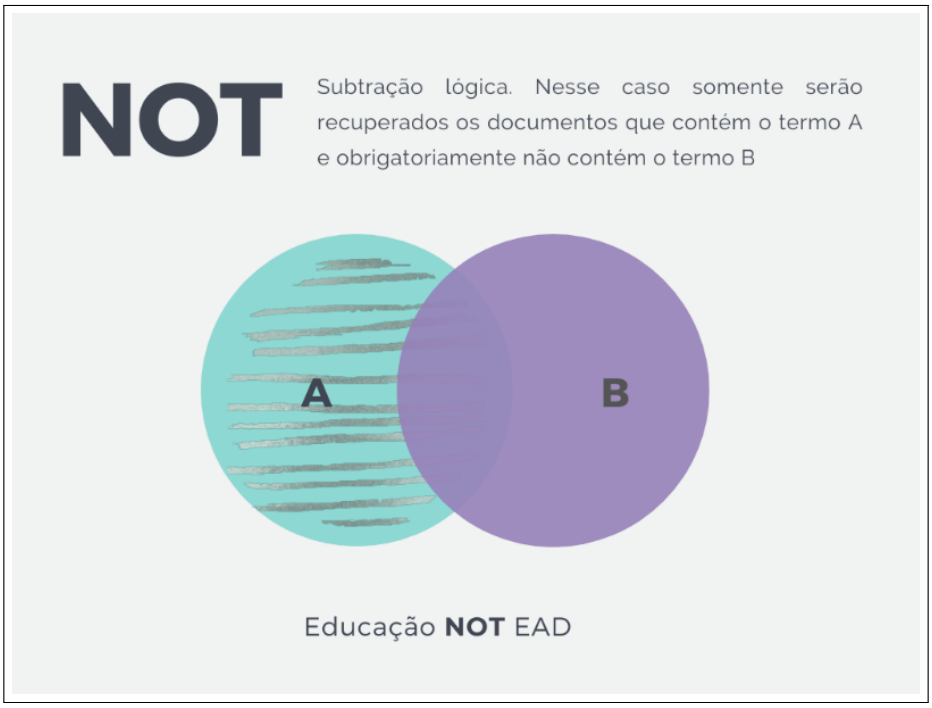

Figure 3. Use of the Boolean Operator NOT

Figure 3 illustrates a search in which the user's objective is to retrieve documents with the term "Education" (A) that do not contain the term "E-Learning" (B). This is used to narrow the search when the primary search term may be associated with another term that is not of interest for that specific search.

In a single search expression, you can repeat the Boolean operator if more than two terms are in use. Figures 4 and 5 present the use of three search terms connected by the same Boolean operator, along with their retrieval area.

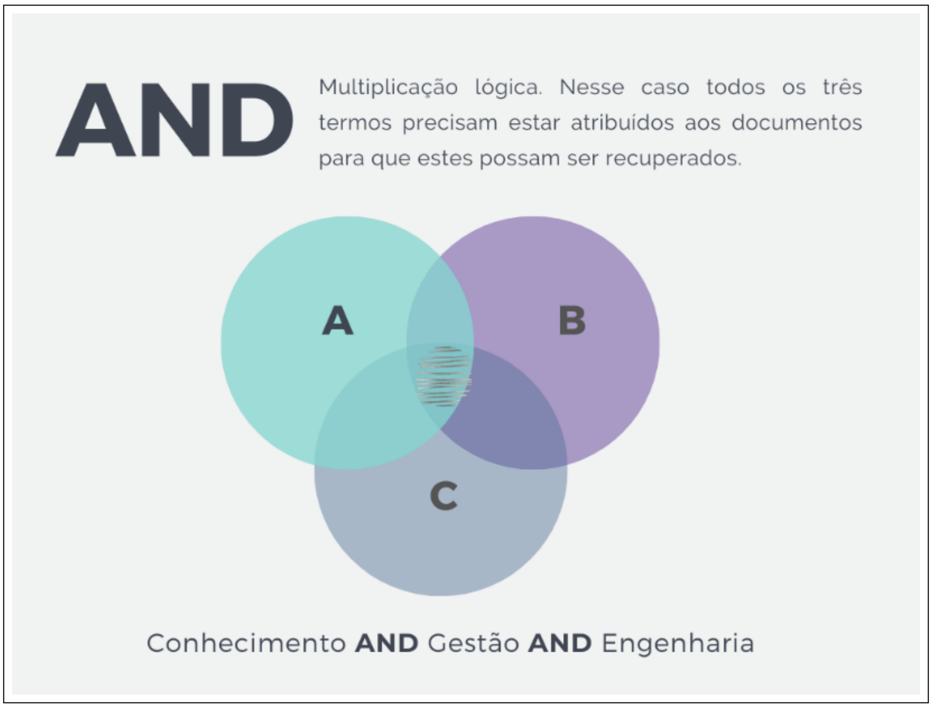

Figure 4. Use of the Boolean Operator AND with More Than Two Terms

In the case of Figure 4, the system will return results, as illustrated, found only in the central portion of the diagram, which represents the intersection of the three search terms in a single document. This portion of the retrieved documents will necessarily contain the terms: Knowledge, Management, and Engineering.

Figure 5. Usage of the OR Boolean Operator with More than Two Terms

In the research example depicted in Figure 5, the user is searching for results related to teachers and, to obtain broader results, has added synonymous terms. The results will include all documents that mention the terms Teacher, Instructor, or Educator.

When constructing a search query in which the same Boolean operator appears more than once, it is essential for the user to consider whether all those terms make sense based on their meaning in the search, to avoid creating a search expression that may work in the system but becomes redundant.

Figure 6 presents a case of redundancy in the use of the Boolean operator AND in a search query that could have been simplified for greater clarity and effectiveness.

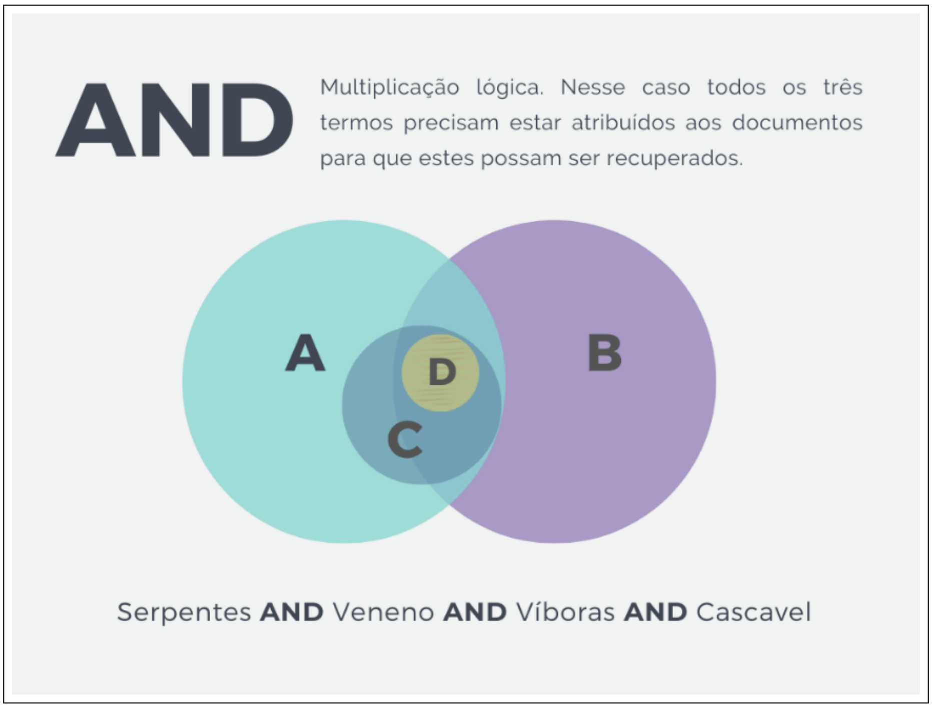

Figure 6. Redundant Use of the AND Boolean Operator with More than Two Terms

In the image, it is possible to identify that the user will reach the expected result - within circle D. However, they have constructed a larger and logically unnecessary search query.

The terms Snakes (A), Venom (B), Vipers (C), and Rattlesnake (D), in this specific search, are redundant in the search query because rattlesnakes are vipers, and every viper is a snake. In other words, regardless of the commands determined by the search query using Boolean operators, all possible results within group (D) are already part of groups (A) and (C), and it is not necessary to explicitly convey this to the system through the search query.

This case is interesting because it demonstrates how the logic derived from Aristotelian thinking influences the way search queries are constructed, even unconsciously.

Every viper is a snake

The rattlesnake is a viper

Therefore, the rattlesnake is a snake

From the general to the particular, in the context of deductive reasoning, such statements highlight the redundancy in the construction of the search query presented in Figure 6. After all, if every rattlesnake is a snake, and the goal is not to perform an exhaustive retrieval of documents containing all the mentioned terms, there is no reason to use all four terms combined to achieve the expected results within the proposed search query. In this case, the expression "rattlesnake AND venom" would bring more precise and satisfactory results to the user searching for documents related to rattlesnake venom.

However, from a "logical" point of view, this makes complete sense. In practice, during subject retrieval searches in scientific databases or any other information retrieval system, it is often important to use different terms to broaden the possibilities of retrieving documents. For instance, one document might have been indexed with snakes, another with vipers, another with rattlesnake, and yet another with venom. Therefore, if you want an exhaustive retrieval with all these term possibilities, using AND between them would be appropriate.

Figure 7 demonstrates a search query derived from fallacious reasoning.

Figure 7. Uso do operador booleano AND em uma expressão de busca errônea

Returning to Aristotelian thought when considering the idea behind constructing a search query. Here we have an example of what we can call a fallacy:

Not every snake has venom

The viper is a snake

Therefore, every viper can or cannot have venom

The reasoning used above to reach the final argument leads to an error, as it is incorrect to claim that a viper can or cannot have venom, while the truth is that all vipers are venomous. Such reasoning can lead the user to create an ineffective search query. The system will interpret the query and return results that necessarily contain both terms, but the research idea behind the query is fallacious and derived from inductive reasoning.

It is also possible to use different Boolean operators in the same search query. Figure 8 and 9 provide examples of this combined use.

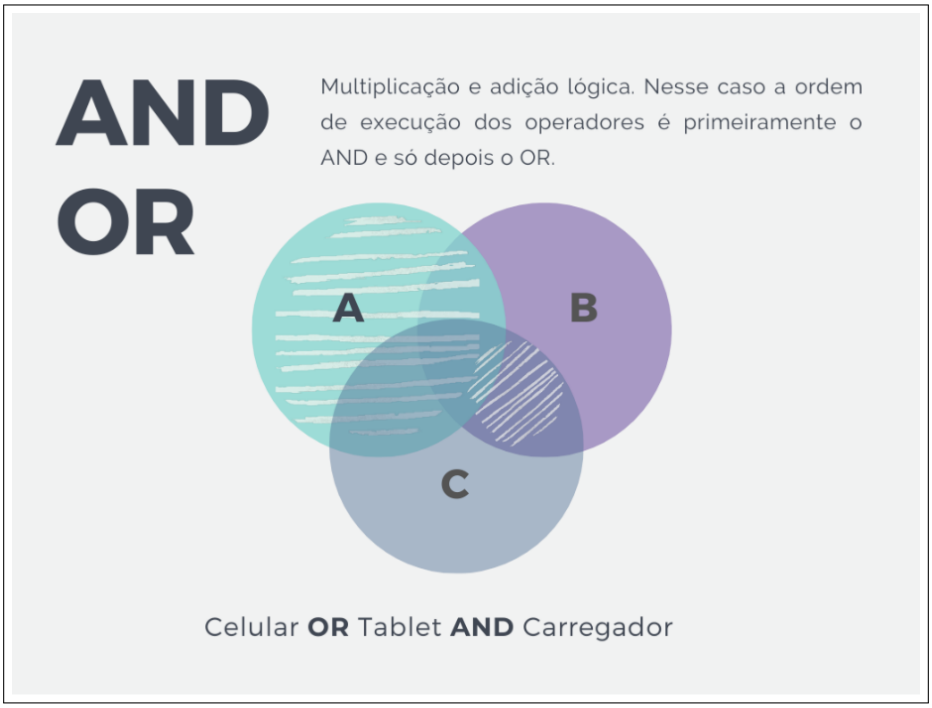

Figure 8. Incorrect Use of the AND and OR Boolean Operators Combined

With a search query structured in this way, the system would initially use the AND Boolean operator in the order in which the terms appear, thus joining Tablet (B) and Charger (C). Only after capturing the results of this operator would it then combine these results with Cellphone (A) using the OR operator. The consequence of this 'disorder' in the Boolean operators results in incorrect results for the main idea of the research. For a successful search, it is necessary for the user to impose on the system the order in which the operators should be executed and, to do this, they must use parentheses ( ), as shown in the figure below.

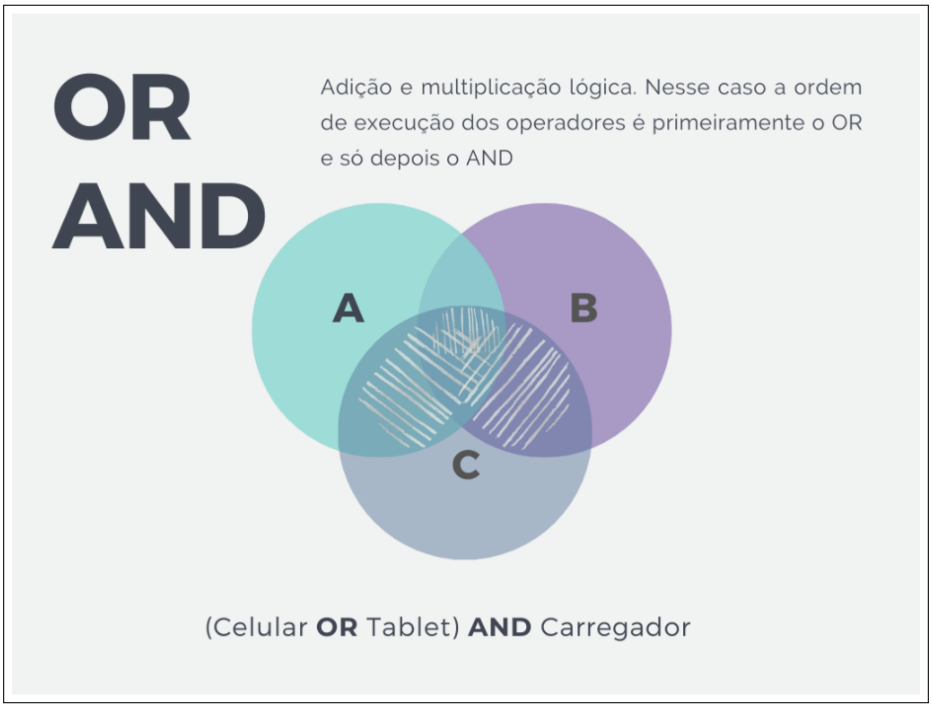

Figure 9. Use of AND and OR Boolean Operators Combined

With the use of parentheses ( ), as exemplified in Figure 9, the system understands that it should first execute the OR operator, combining results that contain the terms Cellphone (A) and Tablet (B) with results that necessarily have a correlation with the term Charger (C).

Parentheses are generally used to group multiple terms and, similar to mathematical formulas, determine the order of resolution when the search query is constructed using different search operators.

In mathematical formulas, the use of parentheses represents the priority of resolution in algebraic expressions.

Example: 4 x (7 + 8) = 4 x 15 = 60

Without the use of parentheses, the result differs.

Example: 4 x 7 + 8 = 28 + 8 = 36

The use of parentheses in mathematical expressions determines priority in operations of multiplication, division, addition, and subtraction. Both in mathematics and in the execution of search queries in information retrieval systems, such as scientific databases, the logic of using parentheses remains the same, prioritizing the order of operators.

As presented in the previous subsection, the use of parentheses is a great ally in formulating a search query with more than one Boolean operator because it communicates to the system in which order it should process the user's search query to return logical results in the executed search.

Example: (Coronavirus OR Covid-19) AND Vaccine

In this situation, the system, when processing the search query, will find articles that contain the term 'Coronavirus' or 'Covid-19' and, after finding them, will select only those that are associated with the term 'vaccine.' Without the use of parentheses, it is not possible to arrive at the same documents.

Example: Coronavirus OR Covid-19 AND Vaccine

If there is no imposed order of resolution on the system, it may interpret the AND operator first—combining documents containing both terms: Covid-19 and Vaccine—then add the results to all other documents containing the term Coronavirus, invalidating the premise represented in the initial search query.

Just as it is possible to use multiple Boolean operators in a single search query, it is also feasible to use more than one pair of parentheses as needed.

Example: ((Coronavirus OR Covid-19) AND (Measles OR Mumps OR Rubella)) AND Vaccine In the example above, the system will initially resolve the two sets of parentheses, performing the multiplication of terms using the OR operator. Subsequently, it will combine the results of both sets in the execution, adding possible combinations of terms within each of the sets using the AND operator. Finally, based on this outcome, it will further combine it with the term 'vaccine,' also employing the AND operator.

The use of parentheses serves as a valuable aid to Boolean operators within specific search expressions and when multiple operators are in use.

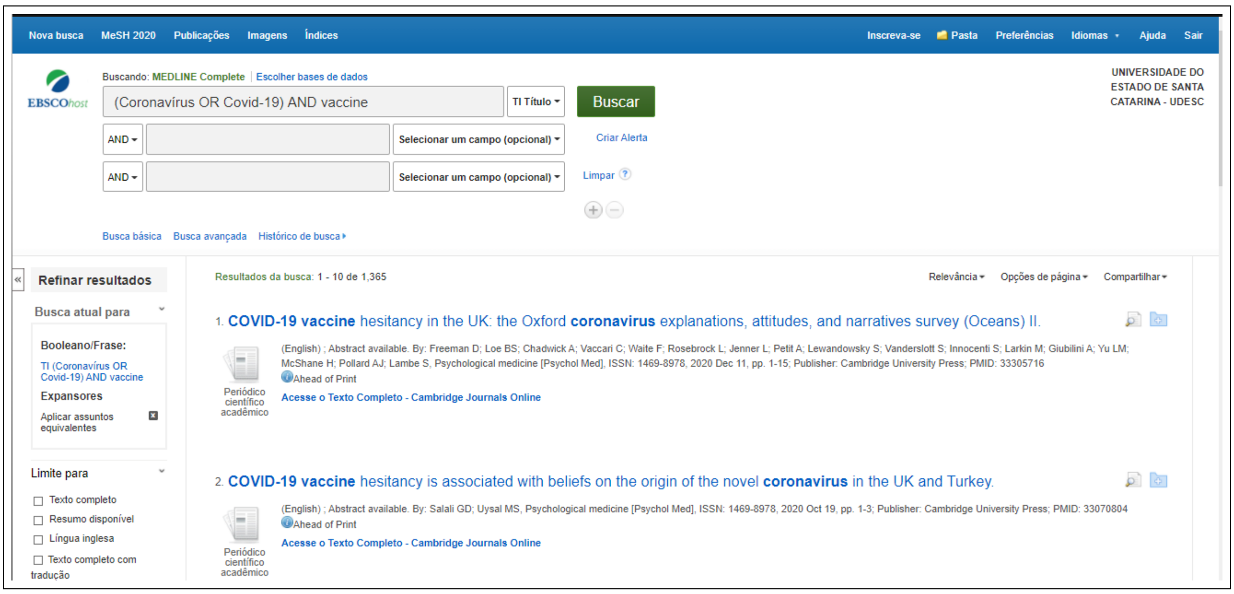

Figure 10. Deployment of ( ) Parentheses in a Search Expression
Source: Medline (2021)

In the situation portrayed in the figure above, English terms were employed due to the characteristics of the selected database. Medline gives precedence to English as the official research language and utilizes the Medical Subject Headings (MeSH) as a controlled vocabulary for document indexing, which is another significant factor in the determination of search terms.

It is essential to note that some systems may occasionally use variations such as AND NOT or may even replace AND with the plus sign (+), OR with the asterisk sign (*), and NOT or AND NOT with the minus sign (-). The usage of AND, OR, and NOT, as depicted in figures 2, 3, and 4, may be subject to equivalent symbols, signs, and other variations according to specific databases. Nevertheless, they are commonly available in the form presented earlier.

FINAL REMARKS

As the abundance of available information on the internet continues to grow, users in need of sources for their scientific research find themselves in a vast landscape with countless possibilities. Emphasizing the step-by-step process of conducting scientific research, where each stage plays a vital role in achieving satisfactory outcomes, the importance of having an accessible and coherent research strategy cannot be overstated. This article has brought together the elements of Boolean logic as a foundation for constructing a research strategy, illustrating them through practical research examples.

It is crucial for readers to recognize that, at the end of this article, each case of crafting search expressions with the aid of Boolean operators is unique. Analyzing the logic behind the formulation is necessary to develop an efficient search expression that fully leverages the operators for precise results.

Furthermore, it is intriguing to contemplate the origins of the fundamental logical principles that guide users in formulating their research strategies. These principles find their roots in Aristotelian philosophy and remain subtly woven throughout the search expressions used as examples in this work.

Logic is instrumental in fostering meaningful dialogues and debates, facilitating rational thinking, and, ultimately, advancing the pursuit of truth. In the context presented in this article, it can be said that logic serves as the cornerstone for the entire structure of research, manifesting itself in the form of search expressions that rely on resources such as Boolean operators.

REFERENCES

Chartier, R. (2003). *Forms and meanings: Written culture between distinction and appropriation.* Campinas, SP: Mercado de Letras.

Chaui, M. (2000). *Invitation to philosophy.* São Paulo: Ática.

Daghlian, J. (1995). *Logic and boolean algebra.* São Paulo: Atlas.

D'Ottaviano, Í. M. L., & Feitosa, H. D. A. (2009). *On the history of logic, classical logic, and the emergence of non-classical logics.* Cruzeiro do Sul Virtual. Retrieved from https://arquivos.cruzeirodosulvirtual.com.br/materiais/disc_2011/2sem_2011/logicaformal/un_II/complementar_II.pdf

Goulart, E. E., & Junior, A. H. (2007). Pesquisas na web: estratégias de busca. *RDBCI: Revista Digital de Biblioteconomia e Ciência da Informação*, *5*(1), 53–66. doi: 10.20396/rdbci.v4i2.2021

Haack, S. (1974). *Deviant logic.* Cambridge: Cambridge University Press.

Medline. (2021). *Scientific database.* Periodicos CAPES. Retrieved from http://webaebscohost.ez74.periodicos.capes.gov.br/ehost/search/basic?vid=0&sid=87def337-4b46-4380-9aa3-f3d01759665d%40sessionmgr4007

Moreira, A. G. S. C. (2007). *Elements of the history of logic* (Master's Thesis). Universidade Portucalense, Porto, Portugal.

Mortari, C. A. (2001). *Introdução à lógica.* São Paulo: Unesp.

Pereira, D. B. (2012). *Analysis of information retrieval models* (Undergraduate thesis). Centro Universitário Campo Limpo Paulista, Campo Limpo, SP, Brazil.

Rowley, J., & Lemos, A. A. B. (2002). *A biblioteca eletrônica* (2nd ed.). Lemos Informação e Comunicação.

Smith, R. (2009). Logic. In *Aristotle.* São Paulo: Ideias & Letras.

Smith, R. (2017). Aristotle's logic. In *The stanford encyclopedia of philosophy.* Stanford Encyclipedia of Philosophy. Retrieved from http://plato.stanford.edu/archives/spr2012/entries/aristotle-logic/

How to cite this article (APA):
Picalho, A. C., Lucas, E. R. O. & Amorim, I. S. (2022). Boolean logic applied to the construction of search expressions. *AtoZ: novas práticas em informação e conhecimento, 11*, 1 – 12. Retrieved from: http://dx.doi.org/10.5380/atoz.v11.81838

NOTAS DA OBRA E CONFORMIDADE COM A CIÊNCIA ABERTA

CONTRIBUIÇÃO DE AUTORIA

Papéis e contribuições	Antonio Carlos Picalho	Elaine Rosangela de Oliveira Lucas	Igor Soares Amorim
Concepção do manuscrito	X	X	
Escrita do manuscrito	X		
Metodologia	X		
Curadoria dos dados	X		
Discussão dos resultados	X	X	X
Análise dos dados	X	X	X

Disponibilidade de Dados Científicos da Pesquisa

Os conteúdos subjacentes ao texto da pesquisa estão contidos no manuscrito.

EQUIPE EDITORIAL

Editora/Editor Chefe

Maria do Carmo Duarte Freitas (https://orcid.org/0000-0002-7046-6020)

Editora/Editor Associada/Associado Júnior

Paula Carina de Araújo (https://orcid.org/0000-0003-4608-752X)

Helza Ricarte Lanz (https://orcid.org/0000-0002-6739-2868)

Editora/Editor de Texto Responsável

Cristiane Sinimbu Sanchez (https://orcid.org/0000-0002-0247-3579)

Nicholle Ferreira Murmel Liali (https://orcid.org/0000-0002-1086-908X)

Editora/Editor de Layout

Felipe Lopes Roberto (https://orcid.org/0000-0001-5640-1573)