ISSN 1798-4769
Journal of Language Teaching and Research, Vol. 15, No. 6, pp. 1899-1909, November 2024
DOI: https://doi.org/10.17507/jltr.1506.15

"Computer" as the Source Domain for "Brain": A Case Study of Online Vietnamese Articles

Nguyen Thi Bich Hanh
Faculty of Culture - Linguistics, Graduate Academy of Social Sciences, Vietnam Academy of Social Sciences, Hanoi, Vietnam

Le Vien Lan Huong
Department of Foreign Languages, Vietnam Military Medical University, Hanoi, Vietnam

Ngo Thi Tuyet
Department of Foreign Languages, Vietnam Military Medical University, Hanoi, Vietnam

Phi Thi Thu Trang
English Department, Thang Long University, Hanoi, Vietnam

Vo Thi My Hanh
Faculty of Basic Science, Vietnam Youth Academy, Hanoi, Vietnam

***Abstract*—Based on the theory of cognitive linguistics, this article investigates computer-related conceptual metaphors in discourses in online Vietnamese newspapers to clarify how Vietnamese people conceptualize the target domain of "brain" via the source domain of "computer". This study aimed to answer two questions: "In online Vietnamese articles, which thinking mechanism is used to conceptualize the human brain as a computer?" and "What similarities from the target domain are activated and mapped onto the source domain?" With the correlations in experience and knowledge projected from the source domain to the target domain, the logical relationship in organizing the mapping scheme of conceptual metaphors, the article points out a type of thinking in the conceptual structure dominated by the 4.0 industrial civilization which is both universal and typical of Vietnamese people's mind.**

***Index Terms*—conceptual metaphors, human brain, computer, mapping**

I. Introduction

According to Lakoff and Johnson (1980), "most of our ordinary conceptual system is metaphorical in nature" as metaphors "structure how we perceive, how we think and what we do" (p. 4). Conceptual metaphors refer to the understanding of one idea in terms of another, which is a systematic mapping from a source domain to a target domain to form a cognitive model reflecting what happens in the mind. The cognitive view of conceptual metaphors is realized by the model "A (Target Domain) is B (Source Domain)" in which a conceptual domain is defined as "any coherent organization of experience" (Kövecses, 2002, p. 4). The source domain provides relatively rich knowledge for the target domain, which takes place through schematic mappings (Kövecses, 2002, p. 12). These mappings play a vital role in explaining why specific attributes of the source domain are used to understand the target domain.

Through the source domain of "machine", the conceptualization of humans, including their minds and bodies, has attracted the attention of scientists, especially cognitive linguists, some of whom strongly support this view (Johnson, 1987, pp. 130-131; Lakoff & Johnson, 1999, pp. 247-255; Kövecses, 2005, pp. 111-112; Kövecses, 2010, pp. 155- 161).

The conceptualization of humans in general and the human mind in particular as a machine dates back to the 18th century; however, 20th-century technology has brought a new concept as a replacement for the machine – the computer. For a long time, the metaphor of the brain as a computer has been used by neuroscientists to explain the brain's powerful computational powers and mind behavior. Still, there hasn't been much research on how this metaphor is realized linguistically. Therefore, the conceptual metaphor model "THE BRAIN IS A COMPUTER" in online Vietnamese newspaper articles will be discussed in detail.

II. Literature Review

The metaphor of the human body as a machine can be traced back to the late 15th and early 16th centuries when a large number of concepts and types of discourse appeared and allowed for the analysis of the body as a steam engine or an internal combustion engine (Gleyse, 2013). More specifically, the BRAIN AS COMPUTER metaphor has facilitated the comprehension of a number of multifaceted phenomena about the human body and mind based on operating principles

and a normative anthropological stance in the universe (Patrzyk et al., 2017). With Industry 4.0 and the rise of smart electronic devices, the focus on digital technology has caused more metaphors to appear in the discourse with the source domains of "electronic devices" or "computer" and the target domains mainly related to "human". In fact, the metaphor "A HUMAN IS AN ELECTRONIC DEVICE" was studied in the context of online Vietnamese electronic newspapers, demonstrating that the components and operating mechanisms of electronic devices are mapped onto the "human" domain, causing human body parts to be thought of as electronic devices such as *chargers, batteries, screens, speakers, switches, screws, transmitters, microprocessors, control buttons*; moreover, the operating mechanism of the human body is visualized the same as electronic devices such as *power down, battery drain, short circuit, IC dampness, switch on, switch off, programming, set up, log out* (Nguyen et al., 2023).

According to neuroscience researchers, brain models are viewed as computers and the mind as its software (Patrzyk et al., 2017). In an article titled "On the Computational Model of the Mind," Radovan (1995), following Searle (1992) and Dennett (1993), also examined the role of figurative language in cognitive science, focusing on the "COMPUTATIONAL METAPHOR OF MIND" metaphor, comparing the brain to a digital computer, or more precisely, proposing an analogy that the mind to the brain is like the software to the computer. According to Pinker (1997), the brain's information processing activities are similar to the activities of a computer in which input information, or raw data, is required to be processed before being used in computational steps and output information. The various functions of the brain are directly compared to computer components where, for instance, the hard drive is the memory, peripheral parts are sensory organs, and so on.

Thus, like other scientific metaphors, the BRAIN IS A COMPUTER metaphor is a valuable tool for explaining complex scientific problems and generating useful ideas (Taylor & Dewsbury, 2018). In terms of communication, computer metaphors are clearly shown in our daily conversations, through linguistic expressions such as *brain lagging*, *ping me later*, *my mind can't process it*, and so on (Baria & Cross, 2021).

There has been much discussion on the BRAIN IS COMPUTER metaphor (Searle, 1984, 1992; Johnson-Laird, 1988; Lakoff & Johnson, 1999). Searle (1984) states that "Because we do not understand the brain very well we are constantly tempted to use the latest technology as a model for trying to understand it" (p. 44). Therefore, the BRAIN IS A COMPUTER metaphor is becoming controversial as the more science develops, the more people see its limitations in explaining the cognitive activities of the human brain, especially in scientific discourse. From a linguistic perspective, the BRAIN IS A COMPUTER metaphor is still an effective cognitive tool for providing knowledge about the human brain, especially for non-experts.

Our research found that, in online Vietnamese newspapers, there are a substantial number of metaphorical expressions in articles with content about or content related to the brain derived from the BRAIN IS A COMPUTER metaphor. The underlying principle is that the human brain is conceptualized as a computer – a smart electronic device – whose various attributes are projected. Some of the examples include *software, operating system, server, CPU, PC, hard drive, security holes, programming, installation, F5, charging battery, switch on, switch off, battery saving mode, shortcut key, hang up, lag, hacked, hijacked, disconnected, stored information, copy, paste, overwritten data*, and more. Therefore, this article will examine metaphorical discourses in Vietnamese electronic newspapers that use the attributes of a computer to clarify the operating mechanism of the brain, thereby pointing out the distinctive features of the source and target domains in this conceptual model.

III. Methodology

In order to research the BRAIN IS A COMPUTER metaphor in online Vietnamese newspapers, a combination of quantitative and qualitative research methods – mainly discourse analysis – was employed. Moreover, statistics and classification techniques were combined in the analysis to achieve the predetermined research goals.

The data was collected from 204 articles on drugs and health taken from the health, entertainment and education sections of 28 official hospital websites, all of which are managed and censored by the Ministry of Information and Communications of Vietnam. These articles were selected from a wide variety of sources to diversify the data using "computer" as a source domain and metaphorize both health issues and human biological functions.

With the collected data, the researchers proceeded to identify conceptual metaphors on the basis of the metaphor identification procedure (MIP) proposed by Pragglejaz Group (2007) as this process is highly applicable and recognized by many other researchers. The MIP process is carried out in four steps as follows:

1. Read the entire discourse in the articles to establish a general understanding;
2. Highlight the words or phrases that have semantic conflict in context;
3. Check if the dictionary definitions of the highlighted words or phrases are understandable or appropriate in relation to other words and phrases in context or not;
4. If not, determine them as verbal metaphors.

The words or phrases that drive this semantic conflict become "metaphorically-expressed words" (which are also known as "tokens" or "vehicles"); the discourses that contain metaphorical references are called "metaphor expressions".

IV. Findings and Discussion

Exactly 326 references to the metaphor THE BRAIN IS A COMPUTER were gathered from 204 articles. According to the principle of partial and unidirectional mapping, the attributes from the source domain "computer" are activated and mapped onto the target domain "brain" which causes the target domain to take on some attributes of the source domain.

Based on the research data from 204 articles found in online Vietnamese newspapers, the conceptual model THE BRAIN IS A COMPUTER is visualized through the mapping scheme shown in Table 1 below.

TABLE 1
THE MAPPING SCHEME OF "THE BRAIN IS A COMPUTER"

Source Domain: COMPUTER		**Target Domain: BRAIN**
Structure of a computer	→	Structure of the brain
Features of a computer	→	Features of the brain
Operating mechanism of a computer	→	Operating mechanism of the brain
Hazards occurring to a computer during operation	→	Hazards occurring to the brain during biological process

In the research corpus taken from online Vietnamese newspapers, many expressions that contain the metaphor THE BRAIN IS A COMPUTER appear with specific metaphorically-expressed words that correlate to each attribute of the source domain. The typical expressions belonging to technical and electronic terminology of the source domain are selected and mapped onto the target domain "brain". In accordance with the hierarchy principle of metaphor, four subordinate conceptual models were derived from the basic metaphor THE BRAIN IS A COMPUTER.

A. Conceptual Metaphor "THE STRUCTURE OF THE BRAIN IS THE STRUCTURE OF A COMPUTER"

The survey found that the discourses in online Vietnamese newspapers contain a number of metaphorical expressions that take the attribute of the structure of a computer to metaphorize the structure of the human brain. The brain's ability to analyze and memorize is so superior that even the latest supercomputers cannot compete with its efficiency. In these metaphorical expressions, metaphorical tokens related to the structure of a computer are found: *memory*, *operating system*, *hard drive*, *CPU*, *PC*, *capacity*, *sensor*, *hardware*, *software*, *configuration*, *server*, *security vulnerability*, *Delete button, pause button, camera button, shortcut keys, and on/off power button* to name a few. These metaphorical expressions appear in online newspaper discourses with relatively high frequency (52 references) shown in Table 2 below.

TABLE 2
CONCEPTUAL METAPHOR "THE STRUCTURE OF THE BRAIN IS THE STRUCTURE OF A COMPUTER"

Source Domain's Attributes	Metaphorically-Expressed Words	Frequency	Source Domain's Attributes	Metaphorically-Expressed Words	Frequency
Structure of a Computer	Bộ nhớ [Memory]	11	Structure of a Computer	Công tắc bật/tắt nguồn [On/off power button]	5
	Hệ điều hành [Operating system]	6		Nút tạm dừng [Pause button]	5
	Dung lượng lưu trữ/ kho lưu trữ [Storage capacity]	5		Phần mềm [Software]	3
	Phần cứng [Hard drive]	2		Nút chụp ảnh [Camera button]	2
	Cục CPU [CPU]	2		Cấu hình [Configuration]	2
	ổ cứng [Hardware]	1		Cảm biến [Sensor]	2
	Máy chủ [Server]	1		Phím tắt [Shortcut keys]	3
	Phiên bản số [Digital version]	1		Nút Delete [Delete button]	1
Total	**52**				

It is obvious from the table above that there are similarities in the mapping structure between the computer and the brain in the conceptual thinking of Vietnamese people. The prominent and preferred expressions in the attribute "structure of a computer" are prioritized to be activated and mapped onto the structural attribute of the brain such as *memory* (11), *operating system* (5), *on/off power button* (5), *pause button* (5), *storage capacity* (4), *hardware* (3), *software* (2), and so forth. These expressions are used to metaphorize the structure of a brain which serves as an operating system with hardware, software and function keys that control all body activities. With such mapping, the human brain is structured like a computer with "hard drive", an information storage device with a particular capacity. For example:

1. *Nếu bạn không thể nhớ một cái gì đó, điều này hoàn toàn hợp lý bởi **"ổ cứng"** của bạn đang chứa quá nhiều những kỷ niệm vô giá trị, và chúng sẽ kết nối sau đó làm ảnh hưởng tới những điều bạn cần ghi nhớ* (genk.vn, 08/02/2015).
   [If you cannot remember something, this is completely reasonable because your "**hard drive**" is filled with too many worthless memories, and they will connect and affect things you need to remember] (genk.vn, February 8, 2015).

2. *"Theo ước tính thì* ***bộ nhớ não người*** có ***dung lượng*** vào khoảng ***vài petabyte,*** *" (1 petabyte bằng 1 triệu gigabyte) giáo sư Reber cho biết* (ngaynay.vn, 31/01/2016).
   ["The **human brain memory** is estimated to have a **capacity** of **several petabytes,** (1 petabyte is equal to 1 million gigabytes)" said Professor Reber] (ngaynay.vn, January 31, 2016).

The human brain also functions like a CPU (*Central Processing Unit*) of a computer. In a computer, the CPU acts as the central processor which includes the electronic circuits in the computer, executing computer programming commands by performing arithmetic, logic and comparison calculations as well as basic data import and export operations specified by the code. Based on mapping correlations in the computer-related metaphorical expressions, the center of the human brain is conceptualized as the CPU of a computer, controlling all operations of thinking as a given programming program. Neurons in the brain act as a "server" controlling the operation of this CPU. When health factors or the body's biological state are unstable, the CPU's operation will be directly affected. For example:

3. *Bộ não của chúng ta có* ***cấu hình*** *rất cổ hủ và cũ kỹ […]* (vietcetera.com, 28/10/2020).
   [Our brains have a very old and outdated **configuration**, […] (vietcetera.com, October 28, 2020).
4. ***Não bộ*** *con người cũng như* ***cục CPU của máy tính****, một đằng thiếu điện thì chạy cà giựt, đằng khác thiếu máu thì sống không yên! Đặc biệt,* ***CPU của người già*** *lại càng rắc rối* (tuoitre.vn, 21/08/2007).
   [Human brains are similar to **CPUs in computers**; the latter functions slowly without power while the former, in the absence of blood, puts life in trouble! In particular, the **CPUs of the elderly** are even more problematic] (tuoitre.vn, August 21, 2007).
5. *Một số nghiên cứu trước đây từng phát hiện,* ***"máy chủ" là một bó tế bào thần kinh trong một vùng não*** *có tên gọi nhân trên trao đổi chéo (SCN)* (vietnamnet.vn, 06/02/2024).
   [Some previous studies have found that the **"server" is a bundle of nerve cells in a brain area** called the suprachiasmatic nucleus (SCN)] (vietnamnet.vn, February 6, 2024).

Belonging to the structure of the computer, the *operating system* is software used to control and manage all components (including hardware and software) of the computer. When the brain is considered as a computer, metaphorical expressions have viewed "mind" as the "operating system" of the brain. In other words, "mind" is the "software" installed inside the brain to control the human machine. While the computer software might encounter problems such as the incompatibility of programs, leading to errors, or creating security vulnerabilities, the human brain functions as an "operating system" which also experiences the problems of program *errors* or *security vulnerabilities* and thus, error correction solutions are needed. For example:

6. ***Hệ điều hành*** *của con người bao gồm mối quan hệ của chúng ta với những người khác hoặc chính chúng ta, thế giới xung quanh cũng như kết nối tâm linh […].* ***Hệ điều hành*** *cập nhật sự* ***không tương thích của các chương trình, lỗi*** *được phát hiện và* ***lỗ hổng bảo mật*** (mlv.pace.edu.vn, 24/10/2029).
   [The human **operating system** includes our relationships with others or ourselves, the outside world as well as spiritual connection […]. The **operating system** updates **program incompatibilities**, detected **errors** and **security vulnerabilities**] (mlv.pace.edu.vn, October 24, 2029).
7. *Có thể tưởng tượng cơ thể chúng ta như một cỗ máy, một phần cứng, còn* ***tâm trí*** giống như ***hệ điều hành,*** chứa các ***phần mềm*** được ***cài đặt để điều khiển phần cứng*** ấy (genk.vn, 05/11/2021).
   [We can imagine our body as a machine, like hardware, while our **mind** is similar to an **operating system**, containing **software installed to control that hardware**] (genk.vn, November 5, 2021).
8. *Điển hình là meme bộ não tìm ra cách* ***sửa lỗi chương trình*** *dưới đây"* (vietcetera.com, 31/7/2021).
   [The typical examples include the memes of the brain that manage to **fix the program errors** below] (vietcetera.com, July 31, 2021).

A computer with a strong configuration will have better performance. When it becomes necessary to update the configuration, people can use a variety of techniques to upgrade the operating system which improves the device's performance and makes it more compatible with contemporary software. When this attribute is projected onto the target domain "brain", the upgradability of the computer is transferred to the target domain, creating metaphorical discourses explaining the impact and enhancement of the brain's flexible operation like upgrading a computer's PC. The following examples illustrate this mapping with particular metaphorical expressions:

9. *Kỹ thuật* ***nâng cấp não bộ*** *như* ***"lên đời" PC*** (khoahoc.tv, 23/02/2021).
   [The technique of **upgrading** the brain like **upgrading a PC**] (khoahoc.tv, February 23, 2021).
10. *Những giải pháp phát triển* ***hệ điều hành não bộ*** *của trẻ* (laodongtre.laodong.vn, 28/04/2023).
    [Solutions to develop children's **brain operating system**] (laodongtre.laodong.vn, April 28, 2023).

In addition to its CPU and operating system, the structure of a computer includes function keys that facilitate the effective execution of commands such as *shortcut keys*, a *pause button*, a *camera button*, and a *delete button*. Similarly, when the human brain is examined within the conceptual framework THE BRAIN IS A COMPUTER, it includes the same function keys as a computer which are expressed by many metaphorical references found in online Vietnamese newspapers. For instance, the "pause" button in the brain is activated when the light is shone on sensitive nerve cells in the brain to turn them on/off as an induction rule, rendering them immobile. The brain also has a mechanism to automatically "clean up" outdated and useless materials to make room for new flows of information and knowledge. The

microglial cells are responsible for this cleaning action. They specialize in cutting away excess connections between neurons to liberate and purify the brain. This is known to scientists as the brain's "Delete button". For example:

11. *Vỏ não thị giác sở hữu "**nút" chụp ảnh**, cho phép ghi lại hình ảnh của môi trường xung quanh với tốc độ rất nhanh* (cand.com.vn, 09/08/2021).
    [The visual cortex possesses a **camera "button"**, allowing images of the surroundings to be captured at a very fast speed] (cand.com.vn, August 9, 2021).
12. *Nhà khoa học đã tìm thấy một **nút "Tạm dừng"** trong không bộ nhớ, khi nhấn vào, toàn bộ cơ sở sẽ không hoạt động* (congnghe.vn, 27/08/2023).
    [Scientists discovered a **"pause button"** in the human memory that, when pressed, causes the entire facility to become inactive] (congnghe.vn, August 27, 2023).
13. *5 "**phím tắt**" kích hoạt bộ não tư duy ngay lập tức* (cafebiz.vn, 21/09/2022).
    [5 "**shortcut keys**" that instantly activate the brain] (cafebiz.vn, September 21, 2022).
14. *Não bộ của bạn có **nút Delete**, đây là cách để sử dụng nó hiệu quả* (genk.vn, 06/02/2016).
    [Your brain has a **Delete button** that facilitates effective brain function] (genk.vn, February 6, 2016).

B. Conceptual Metaphor THE FEATURES OF THE BRAIN ARE THE FEATURES OF A COMPUTER

A computer is an information and data control device with the primary tasks of storing, retrieving and processing data. Considering "computer" as a source domain, metaphorical discourses in online Vietnamese newspapers have activated attributes related to the computer's features to indicate similar attributes of the brain's function. Metaphorical tokens that appear with high frequency include *information processing, data loading, storing, accessing, programming, setting, copying and pasting, backing up, activating, automatically translating, data overwriting* and so on totaling 133 metaphorically-expressed words. Below, Table 3 displays the frequency of these metaphors.

TABLE 3
CONCEPTUAL METAPHOR "THE FEATURES OF THE BRAIN ARE THE FEATURES OF A COMPUTER"

Source Domain's Attributes	Metaphorically-Expressed Words	Frequency	Source Domain's Attributes	Metaphorically-Expressed Words	Frequency
Features of a Computer	Lập trình /tái lập trình [Programming/ reprogramming]	39	Features of a Computer	Truy xuất/truy hồi/tái tạo [Accessing/ retrieving/ recreating]	12
	Sao chép [Copying]	18		Nạp dữ liệu/thông tin [Data/ information loading]	9
	Sao lưu/ lưu trữ thông tin [Data backing up/ storing]	14		Xử lí thông tin [Information processing]	9
	Kích hoạt [Activating]	7		Cài đặt [Setting]	6
	Tải [Loading]	6		Copy và Paste [Copying and Pasting]	4
	Phép tính toán/thuật toán [Calculation/ algorithm]	2		Thiết kế [Designing]	1
	Hiệu suất [Performance]	1		Kết nối mạng lưới dữ liệu [Data network connecting]	1
	Nảy số [Generate]	1		Tự động dịch [Automatically translating]	1
	Lọc thông tin đầu vào/đầu ra [Input/ output information filtering]	1		Ghi đè dữ liệu [Data overwriting]	1
Total	**133**				

A relatively large number of computer-related metaphorical expressions are found in online Vietnamese newspapers. These discourses use the background knowledge structured from the mapping of operational features of a computer onto those of the brain as the central microprocessor of the human machine. Obviously, Vietnamese people demonstrate their preferences for activating metaphors related to some outstanding features of computers such as *programming* (39), *copying* (18), *accessing/ retrieving* (12), *information backing up and storing* (14), and *setting* (6) to metaphorize the features of designing the memory, copying, storing and retrieving information in the brain's memory. The mapping shows that there is an almost 1-1 similarity between the source domain and the target domain in terms of their operating features. The human brain is compared to a computer with the ability of loading data and processing them to create information, knowledge, behaviour, emotion, and so on in humans.

The reflex mechanism installed and preprogrammed into computers also shows how the brain responds when it has to analyze and solve situations. When there is a data network connection, it will automatically "generate" to choose the most suitable solution. For example:

15. *Quá trình mà thi ca nhạc họa dành cho cái tên bay bổng là "lục tìm ký ức", với ngành não học được gọi đơn giản là quá trình truy **xuất và tái tạo thông tin từ bộ nhớ*** (cuoituan.tuoitre.vn, 20/10/2011).

[In brain science, the process that poetry, music and art give the highfalutin name "searching for memories" is actually just the process of **retrieving and reproducing information from memory**] (cuoituan.tuoitre.vn, October 20, 2011).

16. *Lúc này bộ não của bạn đang chuyển sang chế độ tư duy phân tán, giúp bạn **kết nối mạng lưới dữ liệu** và sáng tạo cùng lúc để "**nảy số**" cách giải quyết mới cho các vấn đề cũ* (vietcetera.com, 29-6-2021).
[At this time, your brain is switching to the diffuse thinking mode which enables you to simultaneously **combine data network** and creativity to "**generate**" new solutions to old problems] (vietcetera.com, June 29, 2021).

In terms of computer features, some distinctive properties of the computer such as *programming*, *setting* and *activating* utility software are also mapped onto the target domain. According to the analysis of neuroscientists, the brain is "programmed" to learn a language, enhance thinking ability, and control emotion or behavior just like programming a computer. Thoughts, experiences as well as sad and happy emotions can be programmed into the brain in the fashion people install software in a computer CPU and can be turned on or activated when necessary. For example:

17. ***Bộ não được "lập trình"** để học ngoại ngữ một cách tự nhiên* (thanhnien.vn, 17/12/2015).
[**The brain is programmed** to learn foreign languages naturally] (thanhnien.vn, December 17, 2015).
18. *Thay vào đó, ông cho rằng chúng ta nên rèn luyện não bộ của mình để tiếp nhận những trải nghiệm tích cực bằng cách dành thời gian tập trung vào những trải nghiệm này và **"cài đặt" chúng vào não bộ*** (tamlyhoctoipham.com, 15/11/2017).
[Instead, he suggested that we should train our brains to accept positive experiences by spending time focusing on these experiences and **"installing" them into our brains**] (tamlyhoctoipham.com, November 15, 2017).
19. *Mệnh lệnh khiến bộ não **bật** khả năng phòng vệ và tạo ra những phản ứng chống đối* (vietcetera.com, 28/2/2020).
[Commands cause the brain to **turn on** its defense mechanism and create adverse reactions.] (vietcetera.com, February 28, 2020).

Furthermore, computer software can theoretically be copied and pasted into another memory in order to exchange and store information. These attributes motivate metaphorical discourses expressing that data in the brain can be copied and pasted into another browser like working with an electronic database. For example:

20. *Công ty Samsung đang phát triển phương pháp **"sao chép và dán" bộ não** vào chip máy tính với sự hỗ trợ của các nhà nghiên cứu ở Đại học Harvard* (vnexpress.net, 28/9/2021).
[Samsung Company is developing a method of that involves **"copying and pasting" the brain** into a computer chip with the support of researchers from Harvard University] (vnexpress.net, September 28, 2021).
21. *Não người **sao lưu** hồi ức và duy trì sự sống khi đã chết* (spiderum.com, 20/2/2020).
[The human brain **backs up** memories and maintains life after death] (spiderum.com, February 20, 2020).

Since the brain functions like a computer, it becomes the "digital version" of the mind, which is considered the "software" of the human brain. In some metaphorical expressions, the brain itself also functions as digital software that can be digitized, "uploaded", and "installed" into another mechanical device to fulfill various goals in artificial intelligence technology. For example:

22. ***Tải trí não lên máy tính** (mind uploading) là quá trình **số hóa mọi ký ức, cảm xúc, trải nghiệm, tính cách**... của một người, rồi chuyển toàn bộ dữ liệu vào máy tính hoặc robot để tâm trí người đó có thể sống mãi dù xác thân vật lý đã biến mất* (thanhnien.vn, 15/12/2021).
[Uploading mind to a computer (mind uploading) is the process of **digitizing all memories, emotions, experiences, personality**… of a person, then transferring all data to a computer or a robot to keep so that the person's mind can live forever even though the physical body has disappeared] (thanhnien.vn, December 15, 2021).

C. Conceptual Metaphor THE OPERATING MECHANISM OF THE BRAIN IS THE OPERATING MECHANISM OF A COMPUTER

The mapping resemblance between "computer" and "brain" is also demonstrated in the attribute of an operating mechanism. Computers need to maintain an energy supply to operate. The depletion of energy leads to battery drain and power loss. In order to restart the computer, the battery must be charged to supply and maintain power. Some manufacturers design computers that have additional smart features such as turning on/off preprogrammed modes of battery and energy saving. In online Vietnamese newspapers, there are many metaphorical expressions that use the "operating mechanism" attribute of the computer to describe the operating mechanism of the brain, as in the following examples: *battery charging, turning on/turning off, battery saving mode, super battery saving mode, powering off, disconnecting, automating,* and *maintenance*. The 77 metaphorically-expressed words are presented in Table 4 below:

TABLE 4
CONCEPTUAL METAPHOR "THE OPERATING MECHANISM OF THE BRAIN IS THE OPERATING MECHANISM OF A COMPUTER"

Source Domain's Attributes	Metaphorically-Expressed Words	Frequency	Source Domain's Attributes	Metaphorically-Expressed Words	Frequency
Operating Mechanism of a Computer	Tắt/bị tắt/ tắt điện [Turning off/ being turned off/ powering off]	21	Operating Mechanism of a Computer	Nâng cấp hệ điều hành [Operating system upgrading]	5
	F5/Nhấn F5 [F5/ pressing F5]	6		Ngắt kết nối/hoạt động [Disconnecting/ operation interrupting]	5
	Sạc pin [Battery charging]	5		Khởi động [Starting]	6
	Tiết kiệm pin/siêu tiết kiệm pin [Battery saving/ super battery saving]	5		Tốn năng lượng [Energy wasting]	2
	Cơ chế vận hành [Operating mechanism]	3		Đóng/tắt chức năng [Closing/ turning off a function]	3
	Bật chế độ tiết kiệm pin [Turning on battery saving mode]	2		Tắt chương trình [Turning off background programs]	2
	Chế độ tiết kiệm năng lượng [Energy saving mode]	2		Truy cập [accessing]	2
	Đủ điện [Enough power]	1		Ngắt tạm thời [Disconnecting temporarily]	1
	Tự động hoá [Automatizing]	1		Bảo dưỡng [Maintenancing]	1
	Mạng trạng thái nghỉ [resting-state network]	1		Sửa lỗi chương trình [Fixing program errors]	1
	Mạng chế độ mặc định [Default mode network]	1		Tiết kiệm bộ nhớ [Memory saving]	1
Total	**77**				

It is evident from the statistical table above that Vietnamese people generally choose to use metaphors related to the mechanism of turning on/off computers (21); charging the battery (5); battery saving mechanism (5); upgrading the operating system (5) and cleaning up memory via F5 key (6) to map onto the target domain "brain". That is entirely in line with the role of the "brain" as the central nervous organ that governs all human activities and minds.

In the structure of a computer, apart from hardware and software, the battery plays an important role in energy storage that allows users to be independent of power cords. Each computer's battery has different storage capacities depending on the brand. When the battery runs out of energy, it is time to recharge it. When mapping this attribute to the "brain" as a battery-powered computer, if the brain runs out of "battery" after stressful and energy-consuming working hours or falls into the "power off" state when running special programs, the brain needs charging to maintain its operation. For example:

27. ***"sạc pin" cho não*** *thế nào đúng cách?* (vietnamnet.vn, 16/4/2014).
    How to properly **"charge" the brain**? (vietnamnet.vn, April 16, 2014).
28. *Món ăn nào giúp* ***sạc pin cho não****?* (thuonggiaonline.vn, 12/01/2018).
    [What kinds of food help **charge the brain**?] (thuonggiaonline.vn, January 12, 2018).

It is evident that the operating mechanism of the computer and the human is similar in that both require energy sources to function. During operation, they consume energy and require recovery as well as compensation for lost power when restarting. In Vietnamese metaphorical discourses, the computer's exhaustion of energy is compared to the depletion of the brain's biological energy supply. Charging the computer is mapped onto the operation of brain "charging"; "turning off" computers to charge battery is projected to the act of "turning off" brain activities to charge; and the "power-off" phenomenon of the computer which causes it to stop working is conceptualized as a "power-off" feature of the brain when it falls into a temporary disconnection, as illustrated in the following examples:

29. ***Để não*** *hoạt động tối đa công suất vào ban ngày, ta buộc phải cho nó* ***"tắt"*** *để* ***sạc pin*** *vào ban đêm* (www.prudential.com.vn, 30/11/2021).
    [For the **brain** to operate at maximum capacity during the day, we must **turn it off** to **charge its battery** at night] (www.prudential.com.vn, November 30, 2021).
30. *Phim mát khiến* ***não "tắt điện"****?* (vietnamnet.vn, 26/04/2012).
    [Sex movies **cause** the brain to **power off**?] (vietnamnet.vn, April 26, 2012).

The history of inventions reveals that mechanical computers first emerged in the early 19th century while electrical computers were created in the 20th century. For nearly a century since the invention of the first computer in history, computers have advanced in all aspects, including design, performance, and size. They now enable users to store vast

volumes of information and carry out a wide range of intricate tasks. More sophisticated computers are being designed with the ability to turn on *battery saving or super battery saving mode* to save energy and extend the battery life. With the mapping of these attributes onto the target domain, the brain has the ability to "turn on" or "turn off" its consciousness, or automatically "turn on battery saving mode" when the body's energy level drops. For example:

31. *Khi bạn đói, **não bộ** có thể **bật "chế độ tiết kiệm pin"** và giảm độ phân giải thị giác của bạn xuống* (ttvn.toquoc.vn, 02-07-2022).
    [When you are hungry, your **brain** can **turn on** the "**battery saving mode**" and lower your visual resolution] (ttvn.toquoc.vn, July 2, 2022).
32. *Do đó, các nhà khoa học tin rằng bộ não cũng phải phát triển các cơ chế **"tiết kiệm pin"** cho những tình huống khẩn cấp như thế* (ttvn.toquoc.vn, 02-07-2022).
    [Therefore, scientists believe that the **brain** must likewise develop **"battery saving"** mechanisms for such emergencies] (ttvn.toquoc.vn, July 2, 2022).
33. *Phát hiện "**công tắc" bật - tắt ý thức trong não bộ người**.* (www.vietnamplus.vn, 08/07/2014).
    [Detecting the **on-off "switch" of consciousness in the human brain**] (www.vietnamplus.vn, July 8, 2014).

When the body is short of energy, the brain automatically switches to a "super battery saving" mode to prioritize energy storage for survival tasks. These biological mechanisms operate instinctively, like preinstalled software on a computer. For example:

34. *Nguồn năng lượng dự trữ khi **não chuyển sang chế độ "siêu tiết kiệm pin"** thường được ưu tiên dùng cho việc nghĩ cách tìm thức ăn, đặc biệt ở người* (tuoitre.vn, 13/07/2022).
    [The energy stored when the **brain switches to "super battery saving" mode** is often prioritized for thinking about how to find food, especially in humans] (tuoitre.vn, July 13, 2022).
35. *Các nhà nghiên cứu nhận ra **não bộ** lúc này có thể "quay xe". Nó sẽ giảm hoạt động, **tắt các quá trình tiêu tốn nhiều năng lượng** nhất để đi vào trạng thái **"tiết kiệm pin"*** (ttvn.toquoc.vn, 02-07-2022).
    [Researchers realized that the **brain** is capable of "making a U turn" (make a completely opposite change). It will reduce its operation and **stop the most energy-consuming processes** to enter a "battery saving" mode] (ttvn.toquoc.vn, July 2, 2022).

D. Conceptual Metaphor THE HAZARDS THAT OCCUR IN THE BIOLOGICAL PROCESSES OF THE BRAIN ARE THE HAZARDS THAT OCCUR IN THE OPERATING PROCESS OF A COMPUTER

Computers are the most advanced machines that humans have yet invented. After nearly a century of development, supercomputers are produced with the ability to perform extremely complicated tasks as well as simulate a part of the superior brain structure. However, like all types of machinery, computers also encounter a number of technical problems during operation. Since the brain is conceptualized as a computer, this attribute is also mapped onto the problems that the brain may encounter while carrying out biological processes, impairing the brain's "performance". Some metaphorical tokens that describe hazards during the operation of a computer such as *crash, full hard drive, lag, error, hacked/ hacker, hijacking, security vulnerability*, and the like are found in online Vietnamese newspapers (with 64 references) to explain the most common hazards that the brain may encounter while functioning biologically. The frequency of these metaphorical references is shown in Table 5 below:

TABLE 5
CONCEPTUAL METAPHOR "THE HAZARDS THAT OCCUR IN THE BIOLOGICAL PROCESSES OF THE BRAIN ARE THE HAZARDS THAT OCCUR IN THE OPERATING PROCESS OF A COMPUTER"

Source Domain's Attributes	Metaphorically-Expressed Words	Frequency	Source Domain's Attributes	Metaphorically-Expressed Words	Frequency
Hazards That Occur in the Operating Process of a Computer	Quá Tải [Overload]	25	Hazards That Occur in the Operating Process of a Computer	Bị Lag [Lag]	7
	Hack/Hacker [Hack/ Hacker]	11		Treo Máy [Crash]	6
	Lỗi [Error]	4		Chiếm Quyền Điều Khiển [Hijacking]	2
	Bị Full [Full]	2		Tốn Năng Lượng [Energy Waste]	2
	Hết Dung Lượng [Capacity Exhaustion]	2		Lỗ Hổng Bảo Mật [Security Vulnerability]	2
				Bị Chập [Short Circuit]	1
Total	**64**				

A computer that executes too many programs concurrently or stores too much data on it can easily become overloaded. Similarly, one of the most common problems of the brain is "being overloaded" when having to receive and process excessive information simultaneously. This, of course, can lead to a state of tension, anxiety, lack of emotional control and memory loss. Table 5 demonstrates that in metaphorical discourses of online Vietnamese newspapers, there is a preference for metaphorically expressed words that reflect the hazards during computer operation such as *overload* (25);

hacked and hijacked (13); *lag* (7); *crash* (6); *error* (4) and so forth to represent similar brain disorders. In fact, the phenomenon of overload which is caused by full memory, crash or lag (error) occurs frequently with the computer. In these cases, the "crashed" computer will temporarily cease operating all commands. Likewise, when the brain has "crashed", humans will suffer memory disorders, temporarily stop exploiting their memory, cease adding more data, or even experience a state of abrupt emptiness. For example:

36. *... Dần dần xuất hiện triệu chứng của rối loạn giấc ngủ, tính tình trở nên trầm lặng, ít muốn giao tiếp, hiện tượng này giống như hiện tượng **"treo máy"*** (tuoitre.vn, 20/05/2005).
    [… The symptoms of sleep disorder gradually appeared and they became quiet and unwilling to communicate. This phenomenon is comparable to the **crash** of a computer] (tuoitre.vn, May 20, 2005).
37. *[...] khi bộ óc của các em hoạt động căng thẳng trong thời gian dài, cùng lượng kiến thức khổng lồ muốn nạp thật nhanh trong những ngày cuối cùng nước rút dễ sinh ra hiện tượng **"quá tải"** khiến đầu óc bị **"đơ"** ra, học không vào nữa. Sẽ rất nguy hiểm nếu tình trạng **"treo máy"** này xảy ra đúng vào ngày thi quan trọng của các em* (vtc.vn, 04/07/2014).
    […] when children's brains are working intensely for a long time with a huge amount of knowledge that they want to load quickly in the last few days, it is easy to create the phenomenon of **"overload"** which leads to their mental **"freezing"** and inability to do anything. It will be dangerous if this **"crash"** occurs on their important exam day] (vtc.vn, July 04, 2014).

Being crashed, a computer needs technical intervention such as reinstallation or refreshing. *Refresh*, known as the *F5* key, is a command on computer operating systems that can "revive" the most recent information. It has the ability to assist the computer in clearing off memory and cookies that were previously left on the device. In the same manner, the brain sometimes needs to be refreshed on the outdated interface with "F5 presses". For example:

38. *Các bạn trẻ thế hệ công nghệ cao ví **tâm trạng** mình như một chiếc máy tính đang **"nặng"** vì phải hoạt động quá nhiều **"chương trình"** một lúc, có thể vì **lỗi trong vận hành một phần mềm nào đó**, tóm lại đang **bị "treo máy"**, vậy nên cần một **cú nhấn F5**, tức làm mới, refresh bản thân […] (tuoitre.vn, 23/11/2014)*
    [The younger generation of techies compares their **mood** to a **"heavy"** computer because it has to operate too many **programs** at the same time, or possibly due to **errors in operating certain software**. In short, it is being "crashed", so an **F5 press** will help them refresh themselves […] (tuoitre.vn, November 23, 2014).

A computer can clear up space and fix problems caused by software errors or unwanted information accumulation by restarting. Obtaining this attribute from the mapping, the human brain also has a similar mechanism.

39. *Sử dụng tám kỹ thuật trong bài hướng dẫn này để học cách thư giản tâm hồn và **khởi động lại bộ não** của bạn khi không được nghỉ ngơi trong một thời gian dài* (business.tutsplus.com, 10/8/ 2021).
    [Use eight techniques in this guide to learn how to relax your mind and **restart your brain** when you haven't rested for a long time] (business.tutsplus.com, August 10, 2021).

A computer can be in the state of internet connection or disconnection. This is mapped onto the human brain, where two hemispheres can be operated by purposefully turning off or disconnecting one to prevent a certain bodily reaction for medicinal purposes. For example:

40. *Việc **"tắt" (ngắt kết nối)** một trong hai bán cầu não sẽ giúp bán cầu bị bệnh không gây ảnh hưởng đến bán cầu khỏe mạnh, chấm dứt hoàn toàn những cơn động kinh* (tuoitre.vn, 13/10/2023).
    [**"Turning off" (disconnecting)** one of the two hemispheres will prevent the diseased hemisphere from affecting the healthy hemisphere, completely stopping epileptic seizures] (tuoitre.vn, October 13, 2023).

In the 4.0 digital technology era, computer users still confront hazards such as virus attacks, hacking and hijacking, or data deletion. All of these attributes are mapped onto the target domain "brain". Likewise, the human brain is also susceptible to being attacked, illegally accessed or hijacked by hackers. For example:

41. *Nói cách khác, **bộ não** của bạn có thể **bị hack** và bạn có thể bị ... **chiếm quyền điều khiển*** (baochinhphu.vn, 03/04/2014).
    [In other words, you **brain** can be **hacked** and you can be … **hijacked**] (baochinhphu.vn, April 03, 2014).
42. *Liệu những thiết bị này có thể cho phép những **hacker** với ý đồ xấu **truy cập** vào tâm trí của chúng ta?* (spiderum.com, 19/03/2020).
    [Could these devices allow **hackers** with bad intentions to **access** our minds?] (spiderum.com, 19/03/2020).

V. Conclusion

The study's clarification of the cross-domain mappings in the conceptual metaphor model THE BRAIN IS A COMPUTER on Vietnamese electronic newspapers affirms that the connection circuit between "computer" and "brain" in the thinking of the writers is firmly rooted in both physical and emotional experiences of electronic devices in general and computers in particular. The writers were relatively consistent in perceiving the human brain as a computer with various features. As a consequence, the study established four subordinate structural metaphors, including THE STRUCTURE OF THE BRAIN IS THE STRUCTURE OF A COMPUTER, THE FEATURES OF THE BRAIN ARE THE FEATURES OF A COMPUTER, THE OPERATING MECHANISM OF THE BRAIN IS THE OPERATING MECHANISM OF A COMPUTER, THE HAZARDS THAT OCCUR IN THE BIOLOGICAL PROCESSES OF THE BRAIN ARE THE HAZARDS THAT OCCUR DURING THE OPERATING PROCESS OF A COMPUTER. With so

much diversity and complexity to the computer, the human brain is fully encoded, offering rich imagery for powerful visualizations in writing.

It is apparent that the entire conceptual thinking of THE BRAIN IS A COMPUTER in online Vietnamese newspapers is represented by the image schemas available in the writer's subconsciousness, formed from correlations in experience and background knowledge about "computers" in the era of the 4.0 Technology Revolution when everyone has knowledge and understanding about them. This conceptual thinking lies within a universal cognitive framework and is a continuation of machine metaphors that have prevailed throughout history. The appearance of the source domain "computer" in the metaphor with the target domain of "brain" has contributed to affirming the variability of the metaphor, the influence of the context of the time and the native cognition.

In conclusion, the analysis of THE BRAIN IS A COMPUTER metaphor in Vietnamese makes a significant theoretical addition to metaphor literature and presents an engaging exploration of potential elaborations in this conceptual model that can be of great importance when investigating native people's conceptual processes.

REFERENCES

[1] Baria, A. T., & Cross, K. (2021). T*he brain is a computer is a brain: neuroscience's internal debate and the social significance of the Computational Metaphor*. https://doi.org/10.48550/arXiv.2107.14042

[2] Dennett, D. C. (1993). *Consciousness Explained*. Penguin Books.

[3] Gleyse, J. (2013). The machine body metaphor: From science and technology to physical education and sport, in France (1825-1935). *Scandinavian Journal of Medicine and Science in Sports*, *Wiley*, *23*(6), 758-765. https://doi.org/10.1111/j.1600-0838.2012.01447.x

[4] Group, Pragglejaz. (2007). MIP: A method for identifying metaphorically used words in discourse. *Metaphor and Symbol*, *22*(1), 1-39.

[5] Johnson, M. (1987). *The body in the mind*. The University of Chicago Press.

[6] Johnson-Laird, P. N. (1988). *The computer and the mind*. Harvard University Press.

[7] Kövecses, Z. (2002). *Metaphor: A practical introduction (2nd)*. Oxford University Press.

[8] Kövecses, Z. (2005). *Metaphor in culture: Universality and variation.* Cambridge University Press.

[9] Kövecses, Z. (2010). *Metaphor: A practical introduction*. Oxford University Press.

[10] Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. The University of Chicago Press.

[11] Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought.* Basic Books.

[12] Nguyen, T. B. H., Le, V. L. H, Nguyen, K. C, Chan, H. S. & Ngo, T. T. (2023). The Mapping Mechanism from the Source Domain "Electronic Devices" onto the Target Domain "Human Being": An Online Vietnamese Article Context. *Theory and Practice in Language Studies*, *13*(10), 2577-2588. DOI: https://doi.org/10.17507/tpls.1310.16

[13] Patrzyk, P.M, Link, D. & Marewski, J.N. (2017). Human-like machines: Transparency and comprehensibility. *Behavioral and Brain Sciences*, *40*: e276. https://doi.org/10.1017/S0140525X17000255

[14] Pinker, S. (1997). *How the mind works*. W. W. Norton.

[15] Radovan, M. (1995). On the Computational Model of the Mind, *Informatica*, *19*, 635-645.

[16] Searle, J. (1984). *Minds, Brains and Science*. Harvard University Press.

[17] Searle, J. (1992). *The Rediscovery of the Mind.* The MIT Press.

[18] Taylor, C., & Dewsbury, B. M. (2018). On the Problem and Promise of Metaphor Use in Science and Science Communication. *Journal of Microbiology & Biology Education*, *19*(1). https://doi.org/10.1128/jmbe.v19i1.1538

Nguyen Thi Bich Hanh received a doctorate in Linguistics in 2015 from the Vietnam Academy of Social Science and is currently the Head of Linguistic Studies in the Graduate Academy of Social Sciences at Vietnam Academy of Social Science. Her main relevant fields are Cognitive Linguistics, Semantics and Pragmatics. She has published three monographs on Cognitive Linguistics, written a variety of scientific journal articles both domestically and internationally in relation to her fields of research, and was head of two ministerial research topics on conceptual metaphors. https://orcid.org/0000-0002-5928-4613

Le Vien Lan Huong, who received her Ph.D. in Linguistics in 2023 from the Vietnam Academy of Social Sciences, is currently a lecturer of English at Vietnam Military Medical University. She has written multiple scientific papers published domestically and internationally. Her major research interests include Cognitive Linguistics, Contrastive Linguistics, and English Language Teaching and Learning. https://orcid.org/0009-0000-9566-1685

Ngo Thi Tuyet, who received her Master's degree in Linguistics in 2015, is currently a Vietnamese language lecturer at Vietnam Military Medical University. She has published multiple scientific works in the field of linguistic studies.

Phi Thi Thu Trang currently serves as the Deputy Head of the English Department at Thang Long University, Vietnam. In 2022, she was awarded a doctorate in Linguistics from the Graguate Academy of Social Sciences, Vietnam. Her research interests are in the areas of linguistics, cognitive linguistics and teaching methodology. She has authored a number of journal articles and conference articles regarding conceptual metaphors and other linguistic issues. https://orcid.org/0009-0009-7935-4656

Vo Thi My Hanh currently serves as the Deputy Dean of the Basic Science Faculty at Vietnam Youth Academy. In 2021, she was awarded a doctorate in Linguistics from the Graguate Academy of Social Sciences, Vietnam Academy of Social Sciences. Her research interests are in the areas of linguistics and teaching methodology. She has authored a number of ESP textbooks, monographs, and dictionaries in addition to a wide range of scientific articles. https://orcid.org/0009-0003-0730-7523