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ARTIGO ORIGINAL

Towards a communication ontology

Em direção a uma ontologia de Comunicação

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RESUMO

Neste artigo, mostramos que o termo comunicação não possui um conceito claro e amplamente aceito entre diferentes campos de estudo. Também propomos um esboço de uma ontologia de comunicação, que pode ser usada para estabelecer uma linguagem, certas definições, conceitos e categorias de existência, e integrar a comunidade científica em um pensamento mútuo em relação a esse domínio de conhecimento.

PALAVRAS-CHAVE: Comunicação; Conceito; Ontologia.

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Hacia una ontología de la comunicación

RESUMEN

En este artículo mostramos que el término comunicación no tiene un concepto claro y ampliamente aceptado entre los diferentes campos de estudio. También proponemos un esquema de una ontología de la comunicación, que se puede utilizar para establecer un lenguaje, ciertas definiciones, conceptos y categorías de existencia, e integrar a la comunidad científica en un pensamiento mutuo en relación a este dominio del conocimiento.

PALABRAS CLAVE: Comunicación; Concepto; Ontología.

Towards a communication ontology

ABSTRACT

In this paper, we show that the term communication does not have a clear and widely accepted concept among different fields of study. We also propose an outline of a communication ontology, in order to show how it can be used to establish a language, certain definitions, concepts and categories of existence, and to integrate the scientific community in a mutual thinking in relation to this domain of knowledge.

KEYWORDS: Communication; Concept; Ontology.

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1 INTRODUÇÃO

The association of a term with its concept is basic for the theory and for the construction of the theory, as it is the point of origin of the research. Thus, a general definition of communication is a necessary condition for the elaboration of a general theory of communication aimed at creating a context for planning and conducting specific research projects. In the paper *What is Communication?*, Ayer (1955) already noticed the lack of clarity in the concept of communication. As he noted, the term communication could refer to the message itself, to the medium for conveying the message, or to the process of transmission:

> When a word is applied to such a variety of things, it is natural for us to assume that they have something in common, something in virtue of which the same word is applicable to them all. In this instance the connecting thread appears to be the idea of something's being transferred from one thing, or person, to another. We use the word 'communication' sometimes to refer to what is so transferred, sometimes to the means by which it is transferred, sometimes to the whole process. In many cases, what is transferred in this way continues to be shared; if I convey information to another person, it does not leave my own possession through coming into his. Accordingly, the word 'communication' acquires also the sense of participation. It is in this sense, for example, that religious worshippers are said to communicate. (AYER, 1955, p. 12).

In the paper *On defining communication*, Nilsen (1957) says that

> The meaning of the word "communcation" is at once both clear and obscure. It is clear enough in convenonal usage, but obscure when we seek to determine the limits of its application. To illustrate, if someone talks to another and common understanding results (indicated by mutually satisfactory action), we have no qualms about saving that communication has occurred. If, however, misunderstanding results (indicated by mutually unsatisfactory action), we are uncertain whether we should say that there has been poor, or no, communication. (NILSEN 1957, p. 10).

Nilsen cites other situations in which it is difficult to say whether or not there has been communication: when someone has acquired some feelings about another one even without speaking; when someone "fishes" a conversation; when someone deduces something about her/his neighbors from the behavior of her/his children or the appearance of her/his house; etc.

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Dance (1970) examined the multiple definitions of the term *communication* in the light of the meaning of "concept" as reflected in the philosophy of science literature. From various publications and fields, Dance collected approximately 4,560 words or tokens, classifying thirty different terms from which fifteen were derived that he considered to be distinct conceptual components.

Johannesen (1971) defends the need to associate the concept of communication with dialogue, in which the latter is an orientation that values sharing and mutual understanding between the interactors.

Watson and Arnold (2006) see communication as a process following the models of Shannon and Weaver, and Osgood and Schramm. However, they do call for a reflection on the definitions of communication according to the theoretical frameworks employed and the emphasis on certain aspects of this process.

Steinfatt (2009) argues that the problem of defining communication is not to discover the correct meaning of the term, but to construct a useful definition for studying communication. On one hand, he distinguishes several communication features that affect the usefulness of definitions. On the other hand, he assumes a model of transmissive communication (speaker to listener) and fails to address alternative models that highlight the constitutive and systemic characteristics of communication.

Coates (2009) tried to summarize the many different definitions found in the literature for the term *communication* in three simple definitions: (1) Communication is the sharing of information; (2) Communication is the giving and receiving of messages; (3) Communication is the transfer of information from one or more people to one or more other people. Definition (1) is the simplest, and also the broadest. Because of those qualities, it is also a little nonspecific. Definition (2) reminds us that information, here called a message, must be received, as well as sent, to complete the process. For example, a message launched in a bottle might achieve communication, but it also might not. None of the above definitions requires information to flow in more than one direction (though the first two do rather imply this). Two-way communication is

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certainly more common, and is often preferable, but a one-way delivery of information, such as advice or instructions, still constitutes communication. Definition (3) only applies to communication between people. Animals, plants and machines are also capable of various sorts of communication, but they are not included in this definition.

In the following, we show some definitions for communication in two different fields of research, which explain the lack of consensus regarding the concept.

2 A SINGLE "COMMUNICATION"?

Several fields of study use communication as one of their central concepts: Public Relations, Journalism, Teleinformatics, Telecommunications, Ethology, Philosophy, Semiotics, Pedagogy, Sociology, Information Science, Languages, Linguistics, among others. There is no unity of the definiendum both inter and intra-fields given the scarcity of systematic theory building based on a commonly accepted definition for this term.

We do not untend to survey the different definitions for the term *communication* evaluating their differences, since there are several works with such scope: see, for example, Watson and Arnold (2006), Steinfatt (2009), Coates (2009). Here we will limit the perspectives on the communication concept provided by authors from two different fields of study: Communication and Information Science.

Hartley (2004) provides a short definition for communication: communication is "interaction through mutually recognized signals." (HARTLEY 2004, p. 32). As Watson ans Arnold (2006, p. 138) "interaction is the reciprocal action and **communication**, verbal or non-verbal, between two or more individuals, or two or more social groups" (emphasis added). According to the *Cambridge Dictionary*[1], "interaction is an occasion when two or more people or things **communicate** with or react to each other" (emphasis added). Therefore, Hartley's communication concept is a recursive definition.

[1] Link: https://dictionary.cambridge.org/pt/dicionario/ingles/interaction.

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Another problem is that this definition implicitly implies circular or feedback communication. As we will see later, there can be communication without necessarily having feedback, especially in communication between artificial devices. But not only; for instance, when an organization issues an announcement, there is usually no feedback.

Also, the above definition excludes intrapersonal communication, that of the individual with her/himself, through inner thoughts, impressions, and memories that interact with external stimuli to create a silent speech, continually changing and renewing himself and influencing her/his perceptions of her/himself and the world.

Let us now look at two definitions of communication provided in a Information Science work, the *Computer Science and Communications Dictionary* (WEIK, 2000). The first Weik's communication definition is that "[communication is] the process of transferring information between entities, such as people, places, processes and machines"; his second definition is: "[communication is the process of] transferring information between a source and a destination over one or more channels in accordance with a protocol and in a form suitable for interpretation or understanding by the receiver." Both definitions refer to information transfer, indicating a process that follows the Shannon and Weaver Model, that is, communication is a message transfer process, without necessarily having feedback from the receiver. For example, a control system usually involves sensors, which acquire data from the process or system and transmit it to a controller, which in turn sends commands to actuators. Consider the temperature control system of a boiler, in which a thermostat monitors the temperature and sends the collected data to the controller. According to the temperature value received, the controller sends a command to turn the boiler on or off. In this system, the thermostat is just an emitter and the actuator is just a receiver; the controller has both roles, but not in relation to the same entities: it is receiver for the thermostat and emitter for the actuator.

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In fact, in the Information Technology (IT) community, the interchange of the verbs *communicate* and *transmit* is common, as in this text fragment: "Sensors in these multi-hop networks detect events and then **communicate** the collected information to a central location where parameters characterizing these events are estimated." (BANDYOPADHYAY; COYLE, 2003 p. 1713; emphasis added). Here, clearly the verb communicate is used in the sense of transmitting information. The emitters (sensors, in this case) do not expect feedback from the receiver (the central).

The differentiated perspective of communication in the two fields of study is emblematic of the discrepancy in the use of the communication concept in theory and in practice. A single concept is difficult to achieve, as certain definitions are already well established in certain fields of study. On the other hand, several authors have refined the concept through categorizations. Next, we will see some of them.

2.1 Explicit communication and implicit communication

Still in the first half of the 20th century, Sapir (1933) identified that communication can be unintentional and categorized it into *explicit communication* and *implicit communication*. The first category is the communication that uses language to establish a common understanding between people; the second category encompasses processes of intuitive interpretation of the relatively unconscious symbolism of gestures and the unconscious assimilation of ideas and behavior from the culture of others. Non-communication itself is a form of communication: when we remain silent in front of someone who tries to establish a dialogue, we are still communicating, even if negatively and we are part of an interaction, whether we like it or not.

Similarly, Nilson (1957) distinguishes communication between *instrumental communication*, which is intended to stimulate a response, and *situational communication*, which encompasses situations in which there is no intentional transmission of stimuli to evoke a response. Morris (1946) uses the word *communization* to refer

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to more general interaction, whether or not the use of signs. He exemplifies a form of communization like a person's sadness that makes those around them sad as well.

We highlight that the expressions *explicit communication* and *implicit communication* **are not** synonymous for *direct communication* and *indirect communication*, respectively. The first happens when the interlocutor's true intentions are expressed clearly and unequivocally. The second happens when the interlocutor purposely hides his intentions; for example, to avoid tensions or to avoid uncomfortable situations.

2.2 Intrapersonal, interpersonal, and mass communication

Intrapersonal communication is communication carried out by an individual with himself using internal vocalization or reflective thinking. Like other forms of communication, it is triggered by some internal or external stimulus. We may, for example, communicate with ourselves about what we want to eat due to the internal stimulus of hunger, or we may react interpersonally to an event we have witnessed. Unlike other forms of communication, intrapersonal communication only takes place inside our mind, but it assists in various social functions (INTRAPERSONAL; 2022). Internal vocalization, or talking to oneself, can help the individual to reach or maintain social adjustment. For example, a person might use self-talk to calm down in a stressful situation, or a shy person might remember to smile during a social event. Intrapersonal communication also helps the individual to process emotions, to think about something, or to rehearse what we plan to say or do in the future.

Interpersonal communication is that carried out between two or more people, either verbally or non-verbally, in a clear and concise manner. Examples of interpersonal communication include those mediated by messaging apps, e-mail, telephone, etc. Face-to-face communication is also a form of interpersonal communication. According to Berger (2005), interpersonal communication research contributed to at least six distinct categories of investigation: 1) how humans adjust and adapt their verbal

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and non-verbal communication during face-to-face communication; 2) message production processes; 3) how uncertainty influences our behavior and information management strategies; 4) misleading communication; 5) relational dialectic; and 6) technology-mediated social interaction. (We caveat that Watson and Arnold (2006) restrict interpersonal communication to the direct, unmediated communication.)

Mass communication is a kind of mediated communication by which a person, a group of people or a large organization creates a message and transmits it through some type of medium to a large, anonymous, and heterogeneous audience. In mass communication, the source is typically a professional communicator or a complex organization that incurs great cost. The message is typically fast and public. Mass communication feedback is usually indirect and delayed. As noted by Littlejohn and Foss (2009), new technologies tend to blur the lines between mass communication and communication carried out through social networks. With a good computer and basic computer skills, anyone can publish their own professional journal. With the narrowing trend in the terrestrial and cable broadcasting industries, the public is becoming less anonymous and less heterogeneous. Moreover, with internet channels designed to show unique and personalized content, the audience can be relatively small.

2.3 Dialogical communication and monological communication

Dialogic communication is a type of communication that requires the existence of two separate presences, each with its own points of view and enacting its own specificities. For Johannesen (1971, p. 376), dialogic communication is based on an *I-Thou* relationship. It has the following characteristics: (1) genuineness, (honest and direct communication); (2) accurate empathic understanding (respect for the other's point of view); (3) unconditional positive regard (recognition and respect for the uniqueness of the other); (4) presence (focus and participation in communication);

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(5) spirit of mutual equality (respect for the other's point of view); (6) supportive psychological climate (encouraging communication with others).

In contrast, *monologic communication* is one that involves manipulation and control, as one would treat a physical object. It is the embodiment of an *I-It* relationship and obviously adopts a unidirectional approach to the communication transmission model. Johannesen (1996) summarizes the characteristics of monologic communication as follows:

> A person employing monologue seeks to command, coerce, manipulate, conquer, dazzle, deceive, or exploit. Other persons are viewed as "things" to be exploited solely for the communicator's self-serving purpose: they are not taken seriously as persons. Choices are narrowed and consequences are obscured. Focus is on the communicator's message, not on the audience's real needs. The core values, goals, and policies espoused by the communicator are impervious to influence exerted by receivers. Audience feedback is used only to further the communicator's purpose. An honest response from a receiver is not wanted or is precluded. Monological communicators persistently strive to impose their truth or program on others; they have the superior attitude that they must coerce people to yield to what they believe others ought to know. Monologue lacks a spirit of mutual trust, and it displays a defensive attitude of self-justification (JOHANNESEN, 1996, p. 69).

Mass communication is essentially non-dialogic, although masked with "interactive" survey questionnaires. Sometimes, communication that appears dialogic is, in fact, non-dialogic. This is particularly so when there is a power game involved in which authority overrides reason or common sense. A speaker or teacher who does not interact or does not take on account opinions of "participants" or students practices non-dialogic communication.

2.4 One-way communication and two-way communication

One-way communication is one that occurs when there is no facility or expectation of response or feedback. In other words, it is communication where only one party can transmit. In telecommunications jargon, this type of communication is called simplex-mode communication (FLUCKIGER, 1995, p. 156). Examples of one-way

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communication are advertisements or notices on boards and commercial radio and broadcast TV.

Two-way communication occurs when the recipient sends a response or feedback to the sender of the received message. In telecommunications parlance, this type of communication is called *duplex mode communication*. In the two-way communication process, the sender first transmits the message to the recipient. After receiving a message, the recipient decodes it and sends the reaction to the sender. Two-way communication is not limited to interpersonal communication: it can also involve mechanical devices and not just people (or, more broadly, living beings). For example, in IT, the term two-way communication is used to refer to communication systems in which two parties transmit information to each other. Telephony and videophony are examples of two-way communications. In two-way communication there is also a distinction as the parties can or cannot send messages simultaneously. If they can, the communication is full duplex; if they cannot, it is half duplex (as in walkie talkie radio communication).

All the above concepts are usually associated with the communication system or channel. Still in the context of telecommunications, there is *symmetrical communication* and *asymmetrical communication*. A symmetrical communication system is one in which the speed or amount of data is the same in both directions, averaged over time; in asymmetric communication system the speed differs (for example, in an Internet connection where the download speed is higher than the upload speed).

2.5 Asynchronous and synchronous communication

Asynchronous communication is the term most often used in telecommunications to describe a method of transmitting data that does not require the recipient to be available to receive the information at the time of transfer; instead, the sender may transmit the information at different unsynchronized intervals. This information is collected by the receiver long after it has been transmitted. In terms of communi-

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cation channels, this technique is often employed in e-mails and instant messages, where the availability of the recipient is not required for the delivery of the message.

In synchronous communication, multiple parties participate at the same time and wait for responses from each other. The word *synchronous* means working together at the same time. Chat rooms and online conferences use synchronous communication. In a chat room, people's comments are broadcast immediately, allowing for real-time speech. Other examples of synchronous communication are face-to-face communications, telephone conversations, and video conferences.

2.6 Bipartite communication and multipart communication

A *biparty*, *point-to-point*, *1:1*, or *unicasting communication* is the communication in which only two systems participate. This does not mean that there is only one individual at each end system: for example, in a telephone system where the telephone is on speakerphone, there may be several individuals at each end sytem listening and talking. However, from the point of view of the communication network, there are only two end systems communicating (FLUCKIGER, 1995).

In a *multiparty communication* (or *point-to-multipoint communication*) there are multiple end systems involved. Multipart communication is divided into broadcasting communication and multicasting communication. *Broadcasting communication* refers to communication in which the propagation of information goes from a transmitter to all potential receivers, as in open TV (so often referred as broadcast TV). In *multicasting communication*, propagation goes from the sender to a subset of potential receivers, as in cable TV. Figure 1 illustrates the difference between multicasting and broadcasting communication.

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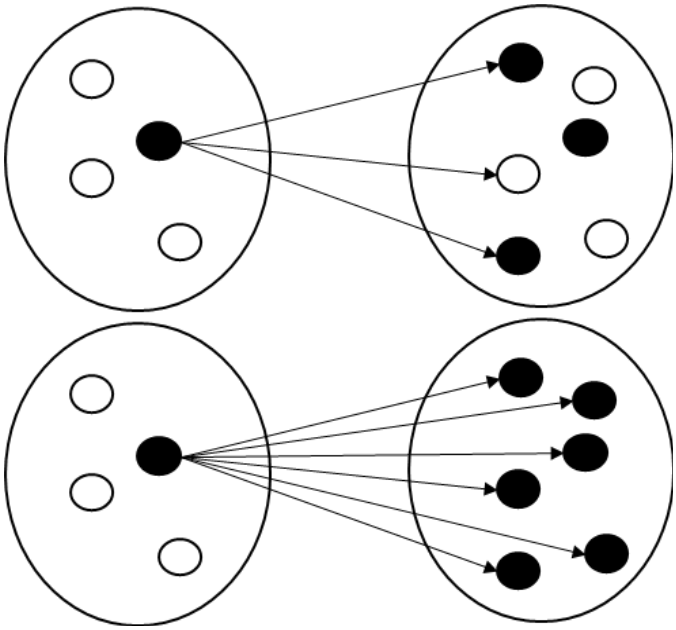
FIGURA 1 – Multicasting and broadcasting communication.



Multicasting communication can be implemented in two ways: closed groups, in which the group of receivers is pre-defined and is under a central authority (which can be the sender); and open groups, in which the group of recipients can spontaneously join or leave the group (FLUCKIGER, 1995, p. 156 and 157). A closed videoconference falls into the first case; cable TV falls into the second case. If the channel used in multicasting communication is bidirectional, allowing all parties to receive and send messages to a system, we have *one-to-many* (1:N) *communication*. An example of this occurs in lives on Youtube in which viewers receive audio and video from the youtuber and can send text messages to her/him. If all parties can communicate with each other, we have *many-to-many communication*.

2.7 Face-to-face communication and mediated communication

Face-to-face communication is a social interaction performed without any mediating technology, being defined as the mutual influence of the individuals' direct physical presence with her/his body language. People are motivated to communicate with others face-to-face to meet interpersonal needs such as inclusion, affection, control,

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pleasure, relaxation, and escape (SCHUTZ, 1966; RUBIN, PERSE & BARBATO., 1988). "Inclusion" refers to a person's need to be included or to include others in a group; "affection" refers to the need to express love or be loved by others; "control" is the need to exercise power over others or allow others to exercise power; pleasure fulfills the personal need to be and remain aroused; "relaxation" fills the need to rest or feel less intense; "escape" refers to the need to avoid activities and concerns by communicating with others.

Mediated communication is communication that makes use of any technical means for transmission over time and space (DAVIS, 2000). Although the technology currently used is often related to computers – hence the term *computer-mediated communication* – mediated technology does not need to be computerized: when we write a letter using a pen and a piece of paper we are also practicing mediated communication. Users of text-based mediated communication have developed strategies to simulate non-verbal elements of face-to-face communication: icons to convey feelings such as sadness, surprise, anger or happiness; intentional miss-pellings; capitalized text to convey screams.

3 FROM THE CONCEPT OF ONTOLOGY

Like communication, the term *ontology* has different definitions in at least two fields of research. In Philosophy, this term is used to designate one of the branches of Metaphysics that comes from the combination of the Latin words *onto* (to be; what is) and *logia* (logical discourse). In this context, ontology, the philosophical study of being in general, or of what applies neutrally to everything that is real. The term was coined by the German philosopher Jacob Lorhard (Lorhardus), who used it in his 1606 work *Ogdoas Scholastica*. Although the term ontology appeared only in the 17th century, the associated concept was introduced by Aristotle in Book IV of Metaphysics, later 300 BC, in which he referred to this area of study as "first philosophy". Later, the concept was popularized by the German rationalist

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philosopher Christian Wolff in his Latin writings, especially *Philosophia Prima sive Ontologia* (1730; "First Philosophy or Ontology"). Wolff contrasted ontology, or general metaphysics, which applied to all things, with special metaphysical theories, such as those of the soul, bodies, or God. Wolff claimed that ontology was an *a priori* discipline that could reveal the essences of things, a view heavily criticized in the late 18th century by David Hume and Immanuel Kant. In the early 20th century, the term was adopted by the German founder of phenomenology, Edmund Husserl, who called Wolff's general metaphysics "formal ontology" and contrasted it with special "regional ontologies" such as the ontologies of nature, mathematics, mind, culture and religion (SIMONS, 2015).

The definition generally used for the term *ontology* in the scope of Information Science is the one given by Gruber (1993): "An ontology is a formal and explicit specification of a shared conceptualization". In this definition, the word "formal" refers to the fact that the ontology must be "understandable" by machines; "explicit" means that the type of concepts used and the restrictions on their use are explicitly defined; "conceptualization" refers to the fact that an ontology is an abstract model of some phenomenon in the world that identifies the relevant concepts of that phenomenon. Ontologies have become a popular topic since the 1990s, investigated by several communities in the field of Artificial Intelligence, including knowledge engineering, natural language processing and knowledge representation, mainly to facilitate knowledge sharing and reuse. Later, its use spread in areas such as intelligent information integration, cooperative information systems, information retrieval, electronic commerce and knowledge management.

The two previous ontology concepts are closely related to their use in both areas of research: whereas in Philosophy, ontologies are used in problems concerning existence and existential assumptions that arise in logic, in Information Science they are used as a mechanism for the common and shared understanding of some

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domains between people and IT systems. In this paper, we use the concept of ontology defined by Gruber (1993).

3.1 The need for a communication ontology

The need for a communication ontology has been perceived by different authors as early as the late 1980s when Frentz and Farrell (1989) noted that "the very concept of communication requires a common ontology that is accessible to its participants through form." (FRENTZ and FARRELL, 1989, p. 335).

Among other authors, Novak-Marcincin, Gîfu and Nicolescu (2014) perceived the need for a communication ontology. Vlăduţescu (2014) listed some gaps that a communication ontology could fill: organizing the field of communication in terms of categories; to systematize the field of communication; establish communicative entities (concepts, categories, paradigms, theories, models, systemic ontological elements, principles, axioms, theorems); establish the relationships between these entities; and define mutually accepted terminology in different fields. Despite these and other authors clamoring for a communication ontology, little progress has actually been made in the development of a communication ontology. Below, we propose some initial steps in this direction.

4 A COMMUNICATION ONTOLOGY

As suggested by Noy and Mcguinness (2001), to start the development of an ontology, we have to define its domain and scope. Among other models, a communication ontology must categorize communication and represent the relationships of these categories with the communication media. This is the domain of the proposed ontology.

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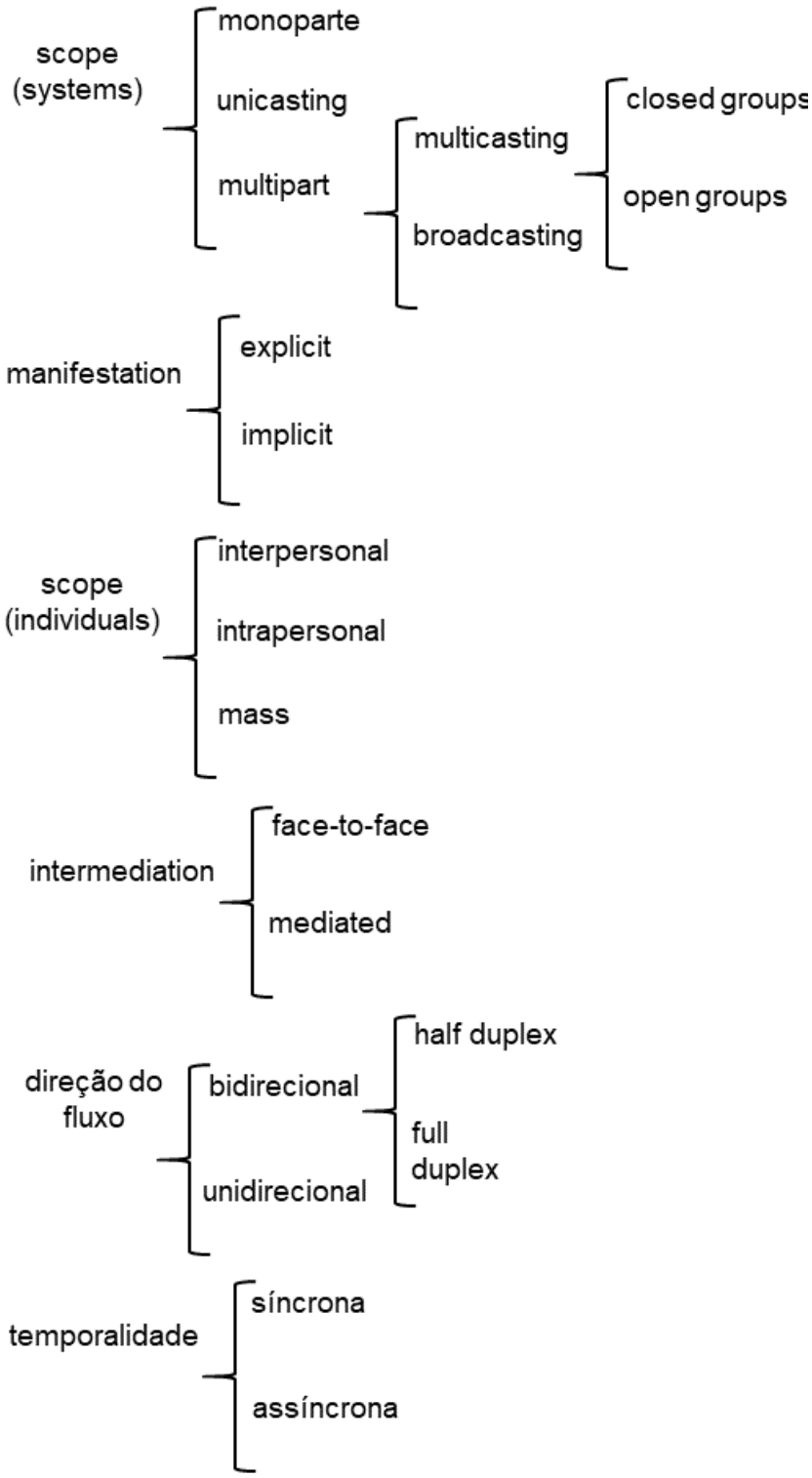
Next, we must enumerate the concepts and try to categorize them. To this end, we use some of the concepts and specializations of the term communication previously seen. Figure 2 shows the categorization result.

FIGURA 2 – Communication categories.



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As we want to represent the relationships between the categories of communication and the media, we are have to also analyze the term *media*, whose concept also varies according to the field of study.

The word *media* comes from the Latin and is the plural of *medium*. According to Hartley (2004, p. 142), a medium is simply any material through which something can be transmitted. Fluckinger (1995), on the other hand, notes that the term *media* has been used in different technical, scientific and economic fields of study, but with one property in common: they all relate media to the treatment of information. He lists the different dimensions of media in:

- storage and processing of information in computing, such as magnetic disks and tapes, optical disks and SSD memory;
- production of information in the press;
- distribution of information, including: telephone, telegrams, pamphlets, radio, walkie-talkie speakers, letter, instant messaging, e-mail, etc. (group communication); newsletters, meetings, murals, memos, circulars, newsletters, bulletins, etc. (organizational communication), mass media - such as newspapers, magazines, broadcast TV and radio, and so on.
- transmission of information in telecommunications, involving different types of physical and logical networks (such as the Internet);
- presentation of information in interactions between people and systems, such as audio, text, moving images and static images (bitmaps, graphics and synthetic images); and
- perception of information in the interaction of people with the world through the senses (touch, sight, hearing, smell, taste).

Starting in the second half of the 1990s, the concept of *social media* also emerged. It is the collective of online communication channels dedicated to community-based input, interaction, content sharing and collaboration. Sites and apps dedicated to forums, microblogs, social networks, social bookmarking, and wikis are among the different types of social media. Nowadays, the line separating social media

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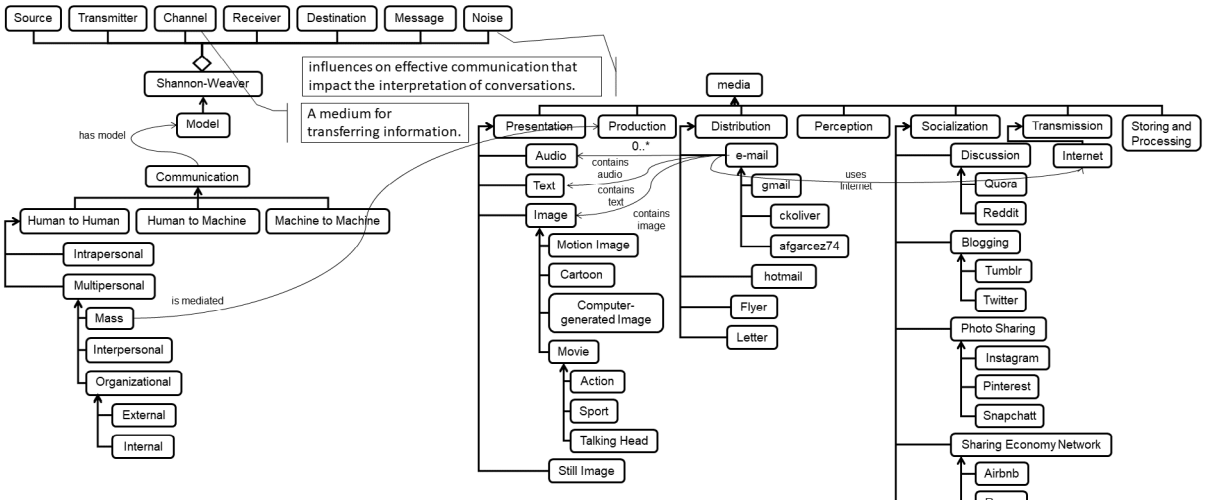
from mass [communication] media is fuzzy. However, we will keep the later in the distribution media category.

FIGURA 3 – Sketch of a communication ontology.



Based on Fluckinger's (1995) categorization extended to include socialization media, we sketched a domain ontology for media shown in Figure 3, on the right. In this graph, the edges (rectangles) are classes (also called concepts because they describe domain concepts); the vertices (lines) represent relationships between the classes. A common type of relationship in an ontology is *is* relationship that establishes hierarchical relationships between classes. For example, in Figure 3 *Distribution*, *Perception*, *Presentation*, *Production*, *Socialization*, *Storing and Processing*, and *Transmission* classes are subclasses of *Media*, which is, in turn, their superclass. A superclass is a generalization; a subclass is a specialization. (For clarity and space, we purposely omitted several subclasses and relationships.)

Classes can (and often do have) *attributes* or *properties*. For example, a reasonable attribute for *Image* class is *Spatial Resolution* whose values represent the number of row pixels by the number of column pixels. The set of possible values for this attribute is defined by technology (333×480, 768×576, 1280×720, etc.). Since *Motion Image* and *Still Image* classes are subclasses of *Image*, they inherit the *Spatial Resolution* attribute. However, they may also have restrictions on superclass attributes and

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new attributes. A particular attribute of *Motion Image* is, for example, *Temporal Resolution* (number of frames per second - fps) whose values range from 1 fps to the maximum allowed by current technologies. In *Cartoon* subclass, *Temporal Resolution* is restricted to a minimum value of 15 fps; for *Recorded Video*, this value must be at least 24 fps to keep motion realistic. However, in *Sport* subclass, the value must be 60 fps, so that shots can be shown in slow motion.

Some of the concepts shown in Figure 3 can be represented as attributes rather than class specializations. In addition, many of them are much more connected to the channel (media) than to communication. For example, timing is directly related to the media used. Thus, the *synchronicity* attribute (with synchronous and asynchronous values) is an attribute of both *Distribution* and *Socialization* media. In media such as *e-mail*, *letter* and *flyer*, the value would be restricted to *asynchronous*; in media *chat* the value would be *synchronous*. Another attribute of *Distribution* and *Socialization* media is *flow* (values: *simplex*, *duplex*, *full duplex*); *email* and *chat* are *full duplex*; *letter* is *duplex*; *flyer*, *simplex*. Here it is worth noting that, in the construction of a domain ontology, the decision to model specific distinctions as attribute values or as distinct classes depends on how important these distinctions are in the domain. If the importance is great, they should be modeled as classes; whether they are of only marginal importance and have no special implications for their relationships to other objects, such as attributes.

In addition to the hierarchical relationship, an ontology can represent other types of relationships. For example, *E-mail* media contains zero or more (0..*) *Audio*, *Text* and *Image* media. *E-mail* also has *uses Internet* relationship with *Internet* media.

The concretization of a class in the real world is an *instance*. For example, the email from ckoliver sent on 08/17/2019 at 10:32 am to the email afgarcez74 is an instance of the Ckoliver class.

Communications may involve different entities, with their own peculiarities. Thus, we specialize communication in, for example, *Human to Machine*, *Machine to Machine*, etc. We could have specializations for all intraspecies (e.g. *Dog to Dog*, *Ant*

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to Ant, etc.) and also interspecies (e.g. *Human to Dog*) communications. Let's focus here only on *Human to Human* communication. We divide this communication into two large categories (classes): *Intrapersonal* and *Multipersonal*, since this first type of communication shares little with communication involving two or more people.

Communication involving two or more people is carried out face-to-face or mediated; it can also be explicit or implicit. So, *Multipersonal* class has two attributes: *way* (*mediated* or *face-to-face*) and *explicitness* (whose values can be *direct* or *indirect*). It is worth noting that not only face-to-face communication, but also mediated communication can be explicit or implicit. A message in an email, for example, may contain veiled elements along with obvious ones. Mass communication is always mediated. Thus, it has an is *mediated* relationship with *Production* media.

Communication has several proposed models. In the ontology shown in Figure 3, *Communication* has a *has model* relationship with *Model*. Just as an example, one of the *Model* specializations shown in Figure 3 is *Shannon-Weaver* class. The relationship of this class with a diamond at the end represents an *aggregation* or *part-whole* relationship. In this case, this relationship says that the Shannon-Weaver [communication] Model is composed of *Source*, *Transmitter*, *Channel*, etc.

We must incorporate a glossary into the ontology. In practice, this can be done through annotations. In addition to the description of concepts, annotations can contain synonyms, versions of terms for different languages or any type of relevant comment. In Figure 3, two annotations are shown to define the concepts of *Channel* and *Noise*.

Ontologies allow the definition of axioms (including rules) in a logical way that together comprise the general theory that the ontology describes in its domain of application. A simple rule example is:

If Communication is Human to Human then
Sender is Human and Receiver is Human.

Human can also be represented through an ontology. In an ontology, axioms can be represented by different formalisms.

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The proto ontology described in this section was modeled using Protégé software. Developed by Stanford University, it is an open source program and is, today, the most used for creating and editing ontologies.

5 DISCUSSION

The term *communication* does not have a clear and widely accepted concept among different fields of study. The conceptual discrepancies of this term and other associated terms bring the need for an ontology of communication, a gap already identified in several works found in the literature. However, there are no (or at least we do not find) works showing, even in an incipient way, this ontology.

In the present paper, we show, in a pragmatic way, how to build an ontology (in the sense of Information Science) of domain for communication. The resulting ontology addresses a very limited subset of the aspects to be covered by a communication ontology: it defines some concepts, categorizes them, and shows the interrelationship between them. It also does not address some important concepts in this domain (e.g. information, knowledge, discourse...). In addition, for reasons of space, many concepts related to communication were omitted (community communication, government communication, social communication, popular communication, alternative communication, etc.).

The construction of an ontology is an iterative and interactive process. Iterative because designers can start with knowledge domain nouns and verbs to sketch the overall structure, and then go through several iterations to refine and correct the structure; interactive because building ontologies in a collaborative and increasingly community-oriented manner has become a central paradigm of modern ontology engineering. Thus, we hope that the communication domain ontology described in this work can serve as a basis for the construction of a de facto communication ontology.

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REFERÊNCIAS

AYER, A. J. What is Communication? *In*: **Studies in Communication**. Londres: Communication Research Centre, University College, 1955, p. 11-28.

BANDYOPADHYAY, Seema; COYLE, E. J., An energy efficient hierarchical clustering algorithm for wireless sensor networks. In: Twenty-second Annual Joint Conference of the IEEE Computer and Communications Societies (IEEE INFOCOM 2003), São Francisco, CA, 2003. **Anais** ... São Francisco, CA, 2003 p. 1713-1723, v. 3.

BERGER, Charles R. Interpersonal communication: theoretical perspectives, future prospects. **Journal of Communication**, v. 55, n. 3, p. 415–447, 2005.

COATES, Gordon Notes on Communication: A few thoughts about the way we interact with the people we meet. 2009. Disponível em www.wanterfall.com. Acesso em 30/08/2019.

DAVIS, Joseph E. Identity and Social Change. **Transaction Publishers**. 2000.

FLUCKIGER, François. **Understanding Networked Multimedia**: Applications and Technology. Hertfordshire, Reino Unido: Prentice Hall International, 1995.

FRENTZ, T. S., FARRELL, T. B. (1989). Language-action: a paradigm for communication. In: BROCK, B. L.; SCOTT, R. L.; CHESEBRO, J. W. (org..). **Methods of Rethorical Criticism: A Twentieth Century Perspective**. Wayne State University Press, 2. ed. 1989. p. 303-320).

GRUBER, T. R. A translation approach to portable ontologies. **Knowledge Acquisition**, n. 5, p. 2, p.199-220, 1993.

HARTLEY, J. **Communication, Cultural and Media Studies**: The Key Concepts. 3rd. edition, London and New York: Routledge, 2004.

INTRAPERSONAL Communication. Introduction to Speech Communication. Available at: <https://www.coursehero.com/study-guides/atdcoursereview-speechcomm-1/92/>.

JOHANNESEN, R. L. **Ethics in human communication**. Prospect Eights, Illinois, EUA: Waveland Press, 1996.

JOHANNESEN, Richard L. The emerging concept of communication as dialogue, **Quarterly Journal of Speech**, v. 57, n. 4, p. 373-382, 1971.

KOLIVER, C.; FARINES, J-M.; BUSSE, B.; DE MEER, H. Rate Control Performance under End-User's Perspective: A Test Tool. EURASIP Journal on Image and Video Processing (Print), v. 2010, p. 1-14, 2010.

LITTLEJOHN, S. W., FOSS, K. A. **Encyclopedia of communication theory**. Thousand Oaks, California: SAGE Publications, 2009.

MORRIS, Charles, **Signs, Language and Behavior**. Nova Iorque: Prentice-Hall, 1946.

NILSEN, Thomas R. On defining communication. **The Speech Teacher**, v. 6, n. 1, p. 10-17, 1957.

DOI 10.5902/2316882X71607
N. 03 / V. 2023

NOVAK-MARCINCIN, Jozef, GÎFU Daniela, NICOLESCU, Adrian. The Standard of Axes in Ontology of Communication, **International Letters of Social and Humanistic Sciences**, v. 41, p. 176-183, 2014.

NOY, Natalya F., McGUIN Deborah L.. Ontology Development 101: A Guide to Creating Your First Ontology. Knowledge Systems Laboratory. 32, 2001.

PICININ JR., D.; KOLIVER, C.; SANTOS, C. A. S. ; FARINES, J-M. Verifying Hypermedia Applications by Using an MDE Approach. In: Daniel Amyot; Pau Fonseca i Casas; Gunter Mussbacher. (Org.). Lecture Notes in Computer Science. 1ed.: Springer International Publishing, 2014, v. 8769, p. 174-189.

PICININ, D.; FARINES, J.-M. ; SANTOS, C. A. S.; KOLIVER, C. A design-oriented method to build correct hypermedia documents. MULTIMEDIA TOOLS AND APPLICATIONS, v. 76, p. 1-30, 2017.

RUBIN, Rebecca B., PERSE, Elizabeth M., BARBATO Carole A. Conceptualization and Measurement of Interpersonal Communication Motives. **Human Communication Research**, v. 14, n. 4, p. 602–628, 1988.

SALES, D. C.; KOLIVER, C.; BECKER, L. B. Ontology and Rules for Characterization of Sensors and Actuators Devices in AADL Models. In: 2020 X Brazilian Symposium on Computing Systems Engineering (SBESC), 2020, Florianopolis. 2020 X Brazilian Symposium on Computing Systems Engineering (SBESC), 2020. p. 1-8.

SAPIR, Edward. Language, *In*: **Encyclopaedia of the Social Sciences**. Nova Iorque, 1933, p. 155-169.

SCHUTZ, W. C. **The Interpersonal Underworld**. Palo Alto: Science and Behavior Books, 1996.

SIMONS, Peter M. Ontology. **Encyclopædia Britannica**. Encyclopædia Britannica, inc., janeiro, 2015. Disponível em: https://www.britannica.com/topic/ontology-metaphysics. Acesso em 29/08/2019.

STEINFATT, Thomas M. Definitions of communication. In: Encyclopedia of communication theory. LITTLEJOHN, Stephen W. e FOSS, Karen A. (org.). Thousand Oaks, SAGE, 2009.

VLĂDUŢESCU, Ştefan. Four Sources of Uncertainty in Communication Ontology, J**ournal of Studies in Social Sciences**, v. 7, n. 1, p. 19-31, 2014.

WATSON, James, HILL, ARNOLD, Anne Hill Hodder. **Dictionary of media and communication studies**. New York: Oxford University Press London, 2006.

WEIK, M. H. Communications. In: Computer Science and Communications Dictionary. Springer, Boston, MA, 2000.

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