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Interactivity

An In-between State

Abstract: Interactivity is a term used in many fields of study including ergonomics, computer science, and psychology. It now refers to a wide variety of features that are particularly present in digital devices. How did interactivity emerge in the context of the 1960s as an inseparable quality of computers that paved the way for personal computing? And how has interactivity become so vital in capturing our attention and clarifying the digital world, a central component in our daily relationship with our increasingly technologized environment?

Keywords: ergonomics, psychology, affordance, dialogue, HCI

The omnipresence of digital technology in our lives makes interactivity an essential characteristic of the contemporary human condition. Our everyday life is made up of interactive experiences that are mediated by a digital device and its interfaces (Vial 2013).

However, much like the notions of "virtual" and "digital," "interactive" is a term that has no stable and unambiguous definition over time. There are several reasons for these shifts in meaning.

Firstly, the word "interactive" can be applied to many different devices and communication situations (whether or not they involve digital technologies). In the broadest sense, interactivity refers to a relationship between two or more agents, human or not, mediated or not by technical means of communication.

The meaning of the term "interactivity," popularized – as we will see – in the field of computer science, has evolved along with technical developments: while it may have been a simple notion in the early days of computing, it has become more complex as interfaces have benefitted from technological advances.

Lastly, the agents involved in an interactive situation change our view of what interactivity is. The scientific literature does not emphasize the same characteristics when it examines human-machine, human-human or human-medium interactions, meaning that ultimately "it is unclear that anyone really knows what interactivity is" (Liu and Shrum 2002).

It therefore seems futile to attempt to produce a single comprehensive definition of interactivity. The main objective here will be to show how the concept of interactivity emerged at the confluence of several theoretical reflections and stabilized in the 1960s with developments in computing (real time, time-sharing, and

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individualization of computer use). We will also see how the term serves as an anchor point for several theoretical and disciplinary practices that aim to shed light on the nature of the relationship between humans and computers.

All things considered, we will try to analyze how the proliferation of interactive situations we now experience in our digital lives is leading to a new stage in the diversification of a term which has come to refer to a wide variety of situations and objects.

1 Starting Points

The first difficulty lies in the large number of definitions of the term "interactivity." The same difficulties apply when attempting to pinpoint when the term emerged. For Andrew Utterson, the first questions about interactivity emerged in the 1960s and 1970s in the fields of the arts and computer science (Utterson 2013). The French sociologist Patrice Flichy traces a genealogy starting with North American interactive television in the 1970s, continuing with the growing convergence between telecommunications and computers and ultimately leading to the major questions raised in the 1990s by the interactivity between microcomputers and users (Flichy 1987). Finally, Pierre Lévy recalls how the interactive map of the city of Aspen developed at MIT in 1979 played a key role in the birth of a dynamic relationship between digital artefacts and users (Lévy 1999).

1.1 Emergence of the Term in the Field of Computer Science

In the 1960s in the United States, the use of computers changed radically (Ceruzzi 2003). The behemoths of the 1940s were replaced by smaller machines that became more individual and flexible in their use. Until then, the use of computers in laboratories and businesses was dependent on batch processing. Machines were supplied with data by means of perforated cards, and computers were set up to perform lengthy tasks, with each task having to be completed before another could be started (Taylor 1967).

Interaction with computers was collective (an extensive technical team worked around one computer, with no one person having full individual responsibility for the task), sequential (the work had to be performed task by task) and diachronic (the way in which information would be processed was planned out before being performed by the computer) (Yost 2017).

The emergence of computers capable of operating in real time (Utterson 2013) – that is, capable of giving a seemingly immediate response to the user – radically changed the way in which computers could be used, giving rise to the concept of interactivity (Bardini 2000).

Computers could now be manipulated individually by a user and operate on a time-sharing basis (allowing several users to access the computer's resources at the same time): this was the advent of the individual's relationship with the computer.

That's when the notion of "dialogue/communication" between the computer and its user appeared. Users now had the impression that they were conversing with the machine: they entered instructions on the machine's keyboard which were followed by effects (visible on a printer, then on a screen), giving the impression that they were conducting a conversation with the computer.

The term "interactive computing" appeared in 1967 (Montfort 2016) in an article by Robert Taylor, who wondered about the best way to make use of the limitless potential of the computer: "Today the question is no longer whether we should bring interactive computing to the sciences, engineering, law, publishing, libraries, the government, economics, banking and finance, manufacturing, management, and education – but how?" (Taylor 1967)

It was at this point that the computer left behind its role as a mere calculator once and for all; it became an information machine that would allow its users to manipulate information through logical symbols (Vial 2013).

1.2 A Complex Genealogy

Nevertheless, it would be an anachronism to claim that interactivity itself spawned reflection about the role that the interactive computer should play in society. It was not until the late 1960s that considerable attention began to be paid to the consequences of the widespread deployment of computers, and whether or not these were desirable. The relationship between the machine and its user was central to these considerations and influenced the way in which interactivity was perceived once the notion emerged in the 1960s. It is possible to identify traces of a "desire for interactivity" that suggest the existence of a complex, non-linear genealogy (Deleuze 1983).

Viewed from a long-term perspective, the interactive functions of computers accelerated the realization of the old dream of "liberation" found in previous media discourses.

Indeed, as early as the nineteenth century, telegraphy gave rise to the desire for interactive communication between transmitters and receivers. People

would "meet" at a prearranged time in two telegraph stations a long way from each other to exchange successive messages and engage in a dialogue that anticipated the immediacy of communication that the telephone would allow a few years later (Flichy 1991). Games of chess were also played on both sides of the Atlantic (Müller-Pohl 2013) and, with the advent of electricity, the period between 1880 and 1925 gave rise to the "first-generation push-button society" (Plotnick 2018) in which Europeans and Americans became accustomed to manipulating their newly interactive technical environment. Even today we continue to "call" the elevator, referring to the action of pressing a button that generates a technical feedback: the arrival of the elevator.

Literature also saw the emergence of interactive reading experiences: long before computers, the romantic novel *Consider the Consequences!* by Doris Webster and Mary Alden Hopkins was published in the United States in 1930, boasting "a dozen or more" different endings depending on the "taste of the individual reader." British gamebooks (or Choose Your Own Adventure books) continued and developed the experience and became world famous before being surpassed in the Web era with fan fiction.

Within the burgeoning field of computer science, as early as 1945, in an often-quoted pioneering article (Bush 1945), Vannevar Bush describes an automated device capable of processing information and putting it "within reach" of users to increase their intelligence. In 1960, it was Licklider who, in a seminal article entitled *Man-computer symbiosis* (Licklider 1960), summed up the advances that would be made possible by the spread of connected computing in society.

Bush and Licklider both refer to the benefits of proximity between the computer and the user. Bush envisioned a menu-based description of the "interactive" parts of a device that were not yet digital but electromechanical (screens, microfilms, notched wheels, etc.). The aim was to facilitate use of the information stored on microfilms by presenting it quickly and legibly. Licklider described the computer as having the potential to improve communication between users connected through networked computers.

In both cases, it was no longer a question of providing information but of co-constructing it with users and their machines. Interactivity implied a radical change of orientation that turned the consumer of information into an actor in its production and circulation.

1.3 Dialogue as the First Interpretative Framework for Interactivity

It was thus in the 1960s that interactive computing (based on the use of real-time processing, personal access to machines and time-sharing) became widespread and popularized equipment that profoundly changed the way computers were used, such as Digital Equipment's PDP-11 (Ceruzzi 2003).

It was also at this point that the first interpretive framework of what digital interactivity was – or should be – began to emerge: what was the nature of the relationship between humans and machines now that people were able to type lines of code on a keyboard that triggered a process on the computer whose result would be printed or displayed on the screen?

This use of code to interact with computers naturally led to talk about "communication" ("human-machine communication") or "conversations" (the term "conversational system," coined well before the use of artificial intelligence, referred to the ability of a system to be interrogated by means of a code entered on a keyboard) and to an understanding of using a computer as akin to engaging in a "dialogue."

The "dialogue" metaphor became commonplace, describing the idea of an autonomous service provided by a machine for a user who was waiting for an "answer". It would continue to be used for a long time: microcomputer users in the 1980s who discovered the joys of programming in Basic spontaneously used the term and the analogy (Thierry 2012).

The work of cyberneticians from the 1950s onwards (Kline 2015) enhanced this definition based on the analogy with human conversation by using the concept of feedback to emphasize that in a situation of interactivity the computer's capacity to adapt to requests took on a particular importance. The aim was not to mimic a dialogue by drawing from a stock of predetermined answers but to adapt dynamically according to an "algorithmic logic" (Vial 2013).

So, interactivity was understood as the ability of a digital device to respond to the multiple demands of its user in an understandable form (through the screen or printer) in a dynamic and instantaneous manner. It was this definition that allowed a first distinction to be made between interactive devices (a computer screen or a printer) and other devices (such as a television or cinema screen) that, while they solicit the user's attention, are not strictly speaking interactive (Vial 2013) because their content is not affected by the solicitations of their audience.

In the 1960s, this definition opened up new possibilities for the use of computers: John Whitney, who was in residence at IBM from 1966 to 1967, argued that real time and interactivity should be used as an opportunity for artists to express themselves more directly through the computer. He used the term "fluidity" to

describe a relationship between a user and a computer in which creativity was enhanced by means of the computer's interactive functions (Wiberg 2018).

2 New Forms of Interactivity

Everyday users of microcomputers and smartphones know that we generally no longer interact with our digital environment through command lines.

Accustomed to icons or menus popularized by Apple and the Palo Alto Research Center, interaction with the digital world is now "symbolic" as it was textual in the early days.

In this context, the dialogue metaphor for interactivity no longer provides an adequate theoretical framework.

2.1 Symbolic Interactivity

Interactivity based on the manipulation of non-text symbols dates back to the very early days of computer science. The Semi-Automatic Ground Environment (SAGE) system, designed in the late 1940s to provide the US Air Force with an airspace surveillance support system, introduced a form of symbolic interactivity. Users would select targets on the radar display with a light pen, and the computer would automatically calculate the location of the target and the intercept trajectory (Machover 1994). Radar operators therefore did not have to use language to interact with the Whirlwind computer that powered the SAGE system (Atkinson 2008) and perform the first "direct manipulation" of a digital object on a screen in the history of computing.

Research on graphical interfaces pursued this path of symbolic interactivity and paved the way for developments in the field of human-machine interaction. In 1963, Ivan Sutherland programmed Sketchpad, which allowed direct interaction on the screen using a light pen (Sutherland 1966), following on from the work carried out on SAGE. On December 9, 1968, Douglas Engelbart, a researcher at the Stanford Research Institute, gave the first "demo" of his OnlineSystem (NLS): a complete set of symbolic human-computer interaction tools (mouse for on-screen designation, chord keyboard for macro commands, hypertext links, etc.).

It was on the basis of these pioneering achievements that the Palo Alto Research Center in the 1970s and the American manufacturers of interactive software thereafter (Apple, Microsoft with Windows, etc.) developed their interactivity regimes based on the desktop metaphor and the designation of symbolic objects on

the screen to open up microcomputing to as many people as possible in the 1980s and 1990s.

This was a major turning point in the history of interactivity, as Pierre Lévy pointed out in an article from the very end of the 1990s: firstly, because the symbolic interface rapidly became widespread, and secondly because it created a new grammar of interactivity: "In a few decades, all terminals will have sophisticated graphical interfaces. Already a new ideography is being born before our eyes. Something like dynamic writing based on icons and diagrams" (Lévy 1999). This grammar of interactivity had its own rules, inertia, and legacies. The resistance of the wastepaper basket that continues to exist on our screens (which we continue to call "desktops") shows the capacity for resistance of the office metaphor that we inherited from the 1970s and which continues to serve as a semantic frame of reference for our relationship with the deletion of digital files (which have nothing to do with a sheet of paper).

Another complication in this history of interactivity (which is deliberately being presented in a non-linear fashion) is the fact that textual modes of interaction remain embedded in symbolic modes of interaction: text remains under our icons for named files, chatbots are becoming widespread thanks to AI and some devices such as the French Minitel even chose to base their whole interaction regime on text rather than icons in the 1980s and 1990s (Thierry 2015; Schafer and Thierry 2012).

Interaction is thus also an assortment of collective knowledge and practices that are learned, imitated and ultimately evolve at a much slower pace than the technology or hardware that supports them: who knows today why an icon used to save a file still looks like a floppy disk?

2.2 Does Interactivity have Politics?

Winner Langdon's question *Do artifacts have politics?* (Langdon 1980) also applies to interactivity, whose consequences on society are by no means merely technical.

The first issue to mention, closely linked to the question of the role that should be given to computers in society from the 1960s onwards, was the question of the role that interactivity should play in empowering users. While the command line was aimed at computer scientists – members of the "technical elite" – the new interactivity made possible by graphic interfaces opened up the possibility of easier access for all those who had not mastered programming languages.

It was during the late 1960s and early 1970s that the theme of user-friendliness as applied to simplified interactivity emerged, thus illustrating the potential

liberating role of the computer (Bardini 2000) if it was allowed to leave the laboratory and be usable by everyone.

However, the issue only really came to the fore at the beginning of the 1980s with the advent of micro-computing, which opened up the market for "neophytes" at work and at home.

But this widespread accessibility was a new notion, and interactivity is like Janus: although it does suggest a desire for simplification and openness, it also embraces other values based on a certain elitism and a broader plan to increase humans' intellectual capacities through the use of machines.

Douglas Engelbart did not have in mind the simplification of the human-computer relationship when he developed the mouse and the chord keyboard; on the contrary, he thought he was helping to "increase" (Engelbart 2012) the user's intelligence with complex tools full of new potentialities. His chord keyboard, studied by Thierry Bardini (1998), crystallized these expectations: by allowing complex key combinations that could be used at the same time as the mouse, it considerably enhanced the possibilities of interaction with digital content on the screen. At the same time, it made it much more complicated to manipulate and learn how to use the system. Far from the promise of natural interactivity made by Apple and the Palo Alto Research Center, interactivity was seen by some as an enhancement project for certain handpicked users.

The difficulty of the process of interacting with computers (even when graphical interfaces are used) gives rise to several definitions of interactivity as an act of surpassing oneself. The interface must be mastered, in the same way as the operation of any tool (Beaudouin-Lafon 2000). Others see it as a process of reciprocal adaptation by humans and machines to reach an optimal state of collaboration with a view to the task to be carried out (Dourish 2004).

The challenges posed by the widespread use of computers in the professional world during the 1970s and 1980s also led to a new kind of technological humanism driven by developments in ergonomics, an old discipline that was being given new objectives. From analyzing how manual workers' bodies could withstand repetitive machine operation, ergonomists now began studying the problems facing tertiary-educated workers using computers. By developing new investigative methodologies, they promoted a "humanistic" approach to the field of ergonomics, proposing that machines should adapt to humans and not the other way around. This trend, which is particularly well represented in Europe (Thierry 2013), sees interactivity as a relationship that must be beneficial to workers and maintains that workers' needs must govern technical development.

So, there is clearly a political dimension to the definition given to interactivity. The elitist vision of "augmentation," the most perfect expression of which can be found in Engelbart, comes up against the vision of a "soft" interactivity

in which technology must bear the essential part of efforts to develop users' understanding. It is this tendency towards invisibility that we find in Donald Norman's work. For him the best interface is one that is no longer visible, that becomes transparent to the user (Norman 1998).

This approach to interactivity is close to the vision of European ergonomics; it is part of a long tradition of research into work and workers and advocates the continuous development, in collaboration with workers themselves, of an interactivity that is perfectly adapted to them (Falzon 2004).

3 An Unattainable Definition in the Age of the Interactive Society

In 1993, the cover of *Newsweek* celebrated the "interactive revolution" that was affecting the way we live, shop, and play. What this consecration of interactivity by the press shows is above all its generalization in a daily environment increasingly colonized by digital technologies.

Mikael Wiberg takes up this topic by seeing in this abundance of interfaces a shift from the information society described in particular by Castells (Castells 2004), focused on information storage and processing of data and transactions, to the interaction society (Wiberg 2005), where contact, networking, and interactivity are the decisive factors in our approach to work and leisure.

It is a shift that also explains why the term is increasingly moving beyond the narrow confines of computer science, where it originated, and being used in an incredible variety of situations that further obscure the establishment of a precise definition: "Interactivity . . . has long been associated with the use of computers that accept user input while a program is running, as opposed to "batch" computers, which process only preloaded data without interruption. Interactive thus came to signify a modern, radically improved technology, usually in relation to an older one. The industrial rhetoric produced concepts such as interactive newspapers, interactive video, interactive television, and even interactive houses" (Aarseth 1997).

3.1 From Affordances to Faceless Interaction

The generalized use of interactive devices creates a need for a generalized definition of the term interactivity in academic research. It is in this context that we see the emergence of a definition of interactivity based on the work of James

Gibson (1977, 1979), a psychologist and ethologist specializing in human and animal perception.

For James Gibson and the many human-machine communication specialists inspired by his work, interactivity refers to the successful use of the affordances created by the designer of a device to accomplish a given task. These affordances do not refer to the autonomous invention of a way of using a device by a user, or to an intrinsic characteristic of the device, but to the series of possibilities for use "staged" by the designer and identified as such by the user. This vision, which banishes the idea that there is a "right way of doing things," is gradually establishing itself as a framework of thought that makes users actors in their environment (albeit a digital one), within which the clues created by the designer(s) allow them to "inhabit" what might be described as an ecological niche (Winograd and Flores 1986). Thus, for Mikael Wiberg, interactivity is the sum of the material elements put at the service of an interactive design project (Wiberg 2018).

Interactivity as "experience" is another definitional framework used in the context of the profusion of interactive devices that we have been witnessing since the 1980s. By focusing on the user's experience to define what interactivity is (McCarthy and Wright 2007), the idea that there is a single way to interact with one's environment is abandoned and the concept of interactivity is enhanced by taking into account the user's perspective, giving rise to an approach that has become known as experience design (Laimay 2017).

These definitions make it possible to go beyond the initial definitional framework of interactivity, one that has proven to be too narrow in light of the subsequent proliferation of possibilities for interaction with an increasingly rich digital environment. Today, we study situations of "faceless interaction" in the material sense of the term, such as those that can be experienced with a voice assistant (Janlert and Stolterman 2017).

These framework variations show the extent to which developments affecting devices and their use (from text to symbol, from hardware to voice interfaces, etc.) have fueled debates about the nature of interactivity.

As many authors have observed, these developments are driven by technology. As is often the case in the digital field, the power of manufacturers and the strength of the market give the impression that theory lags behind innovation.

3.2 Interactivity as a Broad Framework for Interpreting a Digital World

It was also during the period from 1970 to 2000 that the term "interactivity" began to be used to refer to various situations of communication or bringing

people together, going far beyond the initial definition of interactivity between humans and computers.

The vagueness that surrounds the term has played a key role in this extension of meaning: "The word interactive operates textually rather than analytically, as it connotes various vague ideas of computer screens, user freedom, and personalized media, while denoting nothing" (Aarseth 1997).

3.2.1 Interaction, Freedom of Choice, and Consumerism

The growth in television offerings in the United States in the 1970s can be seen as a first stage in the generalization of the use of the term "interactivity" (or the qualifier "interactive") outside the field of information technology.

The possibility of choosing content (Video on Demand, Replays or home shopping (Harrelson 1975) gave rise to a multiplication of discourses promoting the interactivity that television, traditionally considered as a passivity-inducing medium, now made it possible to practise (Galbreath 1996).

As early as 1977, experiments were carried out in the field of cable television in Reading, Rockford and Spartanburg and then with the Qube project in the United States. Qube was an experimental cable television system that played an important role in the history of American interactive television. Launched in Columbus, Ohio, on December 1, 1977 (Greene 1979), the Qube experiment, which was heavily publicized as a revolutionary and "interactive" breakthrough, allowed viewers to discover several concepts that later became essential: pay-per-view programs, specialized cable television networks and so-called "interactive" services such as weather forecasts and teleshopping, the latter becoming ubiquitous in the mid-1980s with the Home Shopping Network (HSN).

However, choosing between several feature films on a pay-TV channel or selecting an item in a teleshopping program is not a matter of interactivity, despite the promotional rhetoric of "interactive television" in the 1970s and 1980s, but an act of content consumption. Unlike browsing a mail-order website, where it is the browsing itself that constitutes the interactive situation, buying on a teleshopping channel, even if the choice of objects is unlimited, is nothing other than an act of consumption that is no different from the way in which we previously chose items from catalogues delivered by post.

3.2.2 Communication or Interaction

Media analysis (following the work of James Carey, one of the fathers of cultural studies in the United States, or Stuart Hall's theory of "active reception" (Hall 1980)) also uses the concept of "interactivity" as a way to refer to a wide variety of situations. Authors such as Henry Jenkins, however, warn against this lack of differentiation, maintaining that a distinction must be made between "communication" and "interactivity" because the former is social and the latter is technological: "For Jenkins the distinction is between technological and social protocols – technical versus social code." (Thorburn and Jenkins 2004 cited in Andrejevic 2016).

It is this blurring of boundaries that, in the 1990s, allowed the term "interactivity" to come to designate all communications (often mediated by digital networks) between individuals or organizations (especially businesses) and consumers or customers. In the early 1990s, Blattberg and Deighton defined it as the ability for an organization or an individual to encounter another market player without geographical distance or time being a factor thanks to new communication tools (Blattberg and Deighton 1991).

Advertising and its market, as reconfigured by the arrival of the Web, suggest a similar analysis. Advertisers are more interested in how technology can be used to add value to the communication process (Johnson, Bruner, and Kumar 2006) than in interactivity itself. Measuring the reception of an advertising message within a community of potential online buyers, possibly interviewing them, is not strictly speaking a question of interactivity; instead, it allows old survey methods to be passed off as modern.

Digital networks certainly give the impression that a vast, borderless global market opened up in the 1990s and that interactivity (here meaning "communication" or "advertising") has become the rule in a globalized society where the freedom to choose a product is an interactive act.

3.2.3 Interaction and Involvement

As we have just seen, the rapid emergence of the Web and its participatory dimension are leading to a further blurring of the boundaries between technical and social interactivity. In her analysis of "participatory" journalism (Usher 2014), Nikki Usher shows how technology, through the tools used in editorial offices and by readers, is transforming readers into agents of interaction with online content rather than mere passive consumers: "Interactivity is a concept long used in scholarship about user-to-computer interaction, and it helps explain

on a broader level the new capacity of users to control the way content is selected or presented to them, whether text, audio, video, multimedia, or something else" (Usher 2014)

What we see here is a confusion between "interactivity" and "participation." Andrejevic warns against this dilution of the specificity of the two terms: "Technically, participation simply means "to take part" in" (Andrejevic 2016). The fundamental difference lies in the fact that participation, unlike interactivity, does not imply a series of reciprocal actions to which actors must mutually adapt. People who leave comments on the sites of major online newspapers often get annoyed by this: their comments are rarely taken into account or do not elicit answers from editorial staff. What is more, the idea of articles written in equal parts by journalists and readers has yet to be explored.

3.3 The Essence of Interaction: Video Games

Video games, the first examples of which date back to the 1950s in American laboratories (we can cite Alexander Douglas' OXO game on Edvac in 1952 or Willy Higinbotham's Tennis for Two at Brookhaven National Laboratories in 1958), can be seen as a remarkably pure embodiment of what interactivity is.

Based entirely on a combination of sensory-motor and intellectual challenges (acting at the right moment in a thoughtful way) (Triclot 2011), the video game is inhabited by what Löwgren and Stolterman define as a "dynamic gestalt": "One of the first attempts to conceptualize interaction, that of Löwgren and Stolterman (2004), provides the important cornerstone that we can use to think about interactive artifacts not only in terms of a user interface and input/output modalities but also of an interactive system's 'dynamic gestalt'." Löwgren and Stolterman suggest that through interaction an artifact reveals its dynamic gestalt. For instance, a classic arcade-style computer game reveals different levels, monsters, obstacles, and challenges along the way as the user continues to interact with the game (Wiberg 2018). The only goal of video games is to offer interactive situations (even narrative-based video games, in which the player is more often passive, offer an interactive challenge at their heart). Unlike word processing software, for example, the interactivity of a video game is not instrumentalized by an external objective (writing a text, producing a document and its layout in the case of word processing), but finds its *raison d'être* in itself: to play is to interact (Vial 2013).

It is for these reasons that video games are used today as a frame of reference for improving other interfaces, such as those of professional software or online services. This approach is called "gamification": "at the core of gamification are

interactive game mechanisms adapted to nongame systems" (Marache-Francisco and Brangier 2015).

There are two major trends in software development that are influenced by gaming today. The first is the revival of symbolic codes that refer to video games (like representing an order of magnitude in gold coins, which is an obvious nod to all fans of games about dungeons and treasures). This shows just how much the video game has become a heavyweight in our digital cultures: its symbols are spreading and becoming an unavoidable reference.

The second trend is the implementation in software of a logic similar to that found in video games. Gratuities for tasks carried out by a professional (score, badges, etc.) are part of this logic, as well as the playful scripting of tasks (in serious games for example).

While interactivity initially focused on how to improve working practices using a computer, video games have made interactivity a central element of our leisure time.

Conclusion

"An interaction, grossly speaking, is a transaction between two entities, typically an exchange of information, but it can also be an exchange of goods or services" (Sharp et al. 2019).

To avoid the vagueness of an overly general definition of interaction and interactivity that would have the merit of applying to all situations but would not allow us to think about the particularities of the concept, we opted for a historical approach to show how the meanings given to the term have changed over time.

The sweet spot of this history is the 1960s. The development of computer science, allowing personal use of computers (with the advent of real time, time-sharing, and human-machine interfaces) paved the way for the emergence of interactivity as a concept and an issue. At that stage, interactivity referred to the user's involvement in the algorithmic functioning of the computer. Seen by computer scientists from the angle of a "dialogue" or "conversation," interactivity then became an issue for psychologists and ergonomists as computers began to pass from the hands of staff trained in their use (computer scientists, the "technical elite") to those of office workers or the general public at home.

It was during the period from the 1970s to the 2000s that the main efforts were made to theorize interactivity. "Dialogue," human-machine "symbiosis" and "experience" became conceptual frameworks for thinking about interactivity and

the ever-increasing number of interactive devices colonizing our workplaces and homes.

In this chronology that sees the term interactivity becoming richer and more diversified, another trend is perceptible, namely the move from technical interactivity to social interactivity. This shift in meaning is not a novelty in itself: as we have pointed out, interactivity is one of the obvious characteristics of interpersonal communication.

Used in the context of television offerings, advertising, online journalism, and the new status given to readers more generally on the Web, the meaning of the term is becoming blurred and its boundaries are becoming fuzzy. Our era is one of interactivity. Web 2.0, participatory journalism, even online sales, everything has become interactive.

The video game, however, is there to remind us that the original sense of the term interactivity – and it is important not to stray too far from this notion – is the relationship established between the user and the algorithmic logic of a digital device that allows an original creation through successive stages of co-construction.

The importance of this definition, which may seem narrow compared to the many other uses that can be made of the term "interactivity," is its fecundity when it comes to the consequences of this relationship between user and computer.

It is this experience of interactivity that lies at the heart of the ongoing fascination for screens and their ability to be powerful "attention sensors" (Vial 2013) on which reflections about attention and the attention economy are based (Citton 2014).

It is also the ability to create using interactive tools that underpins the practice of digital arts, from pixel art to mash up (Miller 2007) and the creation of movie sets.

Politically, interactivity is not neutral, as we have pointed out. It reveals a sharing of power between designers, machines and users. At a time when AI is on the rise, it is more important than ever to reflect on this triad: what freedom is given to users of interactive systems? Is a system still "interactive" when artificial intelligence guides the choices made?

Finally, at the broader level of digital anthropology, in the space of a few years interactivity as an experience has probably become one of the most noteworthy features of our relationship with the world. We are surrounded by devices that interact with us. Robotics gives them an anthropomorphic aspect that allows us to identify them, dream about them, and sometimes fear them. But

voice assistants and automatons in supermarkets, airports, and public transport are all "robots" too. Their capacity for interaction changes our relationship with the world.

For all these reasons, interactivity, however difficult it may be to define, is of vital importance for social sciences. It deserves our full attention – if we still have any left over.

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