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TECHNOLOGICAL REVOLUTION AND SMARTPHONE: CONSIDERATIONS ABOUT THE CONSTITUTION OF THE CONTEMPORARY SUBJECT

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ABSTRACT. The text, resulting from theoretical studies undertaken in the light of Historical-Cultural Psychology between 2016 and 2020, aims to recover the technological revolution as a resource for understanding the constitution of contemporary subjects, starting from the steam engine of the First Industrial Revolution, used in the means of production, even the smartphone, used in everyday life. The smartphone has such high levels of compactness, portability and operability that it has become one of the most advanced technologies in history, revealing the high degree of development of the psyche achieved by mankind. It, more than other digital information and communication technologies, has impacted notably on the constitution of contemporary subjects, especially on their cognitive psychological functions. The results demonstrate that recovering dialectically the historical path of technological creations is essential to Psychology, allowing to expand the spectrum of analysis of how subjects are constituted today. It concludes that the microtechnological revolution must be taken under a critical and ethical bias, due to everything that can impact on the relationships between the subjects and the development of their psychic processes.

Keywords: Historical-cultural psychology; smartphone; human development.

REVOLUÇÃO TECNOLÓGICA E SMARTPHONE: CONSIDERAÇÕES SOBRE A CONSTITUIÇÃO DO SUJEITO CONTEMPORÂNEO

RESUMO. O texto, resultante de estudos teóricos empreendidos à luz da Psicologia Histórico-Cultural entre 2016 e 2020, tem como objetivo recuperar a revolução tecnológica como um recurso para a compreensão da constituição dos sujeitos contemporâneos, partindo da máquina a vapor da Primeira Revolução Industrial, empregada nos meios de produção, até o smartphone, empregado na cotidianidade. O smartphone possui níveis tão altos de compactação, portabilidade e operacionalidade que o tornaram uma das mais avançadas tecnologias da história, revelando o elevado grau de desenvolvimento do psiquismo alcançado pelo gênero humano. Ele, mais do que outras tecnologias digitais de informação e comunicação (TDICs), tem impactado notadamente a constituição dos sujeitos contemporâneos, especialmente suas funções psicológicas cognitivas. Os resultados demonstram que recuperar dialeticamente o percurso histórico das criações tecnológicas é essencial à psicologia, permitindo ampliar o espectro de análise de como

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os sujeitos se constituem na atualidade. Conclui-se que a revolução microtecnológica deve ser tomada sob um viés crítico e ético, por tudo o que pode impactar nas relações entre os sujeitos e no desenvolvimento dos seus processos psíquicos.

Palavras-chave: Psicologia histórico-cultural; smartphone; desenvolvimento humano.

REVOLUCIÓN TECNOLÓGICA Y SMARTPHONE: CONSIDERACIONES SOBRE LA CONSTITUCIÓN DEL SUJETO CONTEMPORÁNEO

RESUMEN. El texto, resultante de estudios teóricos realizados a la luz de la Psicología Histórico-Cultural entre 2016 y 2020, tiene como objetivo recuperar la revolución tecnológica como un recurso para comprender la constitución de los sujetos contemporáneos, a partir de la máquina de vapor de la Primera Revolución Industrial, empleada en los medios de producción, hasta el smartphone, utilizado en la vida cotidiana. El smartphone tiene niveles tan altos de compacidad, portabilidad y operabilidad que se ha convertido en una de las tecnologías más avanzadas de la historia, revelando el alto grado de desarrollo de la psique alcanzado por la humanidad. Él, más que otras tecnologías digitales de información y comunicación, ha impactado notablemente la constitución de los sujetos contemporáneos, especialmente sus funciones psicológicas cognitivas. Los resultados demuestran que recuperar dialécticamente el camino histórico de las creaciones tecnológicas es esencial para la psicología, lo que permite ampliar el espectro de análisis de cómo se constituyen los sujetos en la actualidad. Concluye que la revolución microtecnológica debe tomarse desde una perspectiva crítica y ética, para todo lo que pueda afectar las relaciones entre los sujetos y el desarrollo de sus procesos psíquicos.

Palabras clave: Psicología histórico-cultural; smartphone; desarrollo humano.

Introduction

Our role in the initial and continuing education of school psychologists, as well as professors of basic and higher education, has allowed the identification of complaints about behaviors that many of them consider inappropriate for the activity of study, such as the intensive use of cell phones by students, something that, supposedly, would have negative impacts on schooling. Faced with complaints like this – mitigated by the pandemic triggered by Covid-19 in the first quarter of 2020, which repositions the smartphone as a fundamental resource for remote teaching – we performed a literature survey between 2016 and 2020 to better understand the impacts of Digital Information and Communication Technologies (DICT) on human development. The objective was to recover the technological revolution as a resource for understanding the constitution of contemporary subjects, starting from the steam engine of the First Industrial Revolution, used in the means of production, to the smartphone, used in everyday life.

With this revolution still going on and the transformations happening so quickly, it is not uncommon for significant changes to be faded or naturalized, as new resources and devices appear all the time and, therefore, condemn the previous versions to ostracism, to obsolescence, without we have realized their real dimension.

The speed of change is so dizzying that Rifkin (2014) classifies this era of transformations as the Third Industrial Revolution. Other scholars, according to Perasso (2016), assess that the information technology and telecommunications revolution would already be over, and that we would be at the heart of another – the Fourth Industrial Revolution –, focused on bioscience, robotics and cybernetics. But what none of them denies is that the transformations mediated by DICT are so radical that they have altered ways of living.

For Costa, Duqueviz and Pedroza (2015), the smartphone is part of the DICT or 'new technologies', along with the computer, internet, tablet, etc. The term DICT is an attempt to distinguish it from Information and Communication Technology (ICT), which involves older devices such as television, newspaper and mimeograph. Among the DICTs, the smartphone stands out for its smaller size, lower average cost, greater ease of handling and transport, in addition to capacity and processing similar to those of a computer, a true revolution in microtechnology affecting industry, communication and psyche, transforming social relations and the human constitution itself.

The smartphone, since it became a common good, has made, mainly, the generation of digital natives, which does not know any other world than that of TDICs, to relate, inform and even manage their lives through this tool (Palfrey & Gasser, 2011). Only in Brazil, according to Meirelles (2019), there are more than 230 million smartphones in use, which represents more than one device per inhabitant. Never before has a single, small device condensed such a large set of features that, in the past, were isolated functions of several individual devices, even when in offline mode (without internet connection), which may explain its great success.

To better understand this scenario, we addressed in this study the nature of the machines of the First Industrial Revolution, the extraordinary advances seen in the smartphone and the constitution of the subject today, because, in the midst of such profound transformations, human formation is impacted, demanding a historical understanding of this phenomenon.

The First Industrial Revolution and the nature of the steam engine

Talking about a technological revolution is actually talking about human history. From the discovery of fire to the use of chipped stone tools, from polished stone to the invention of the wheel, from the steam engine to the smartphone, all these are, in fact, technologies created that leveraged the construction of cultural heritage and the human psyche. Understanding, therefore, the nature of the smartphone and the reasons for considering it a device that guides technological, social and psychic changes requires a historical look, especially with regard to one of its most solid foundations, the First Industrial Revolution (1760-1840).

Technological innovations arise ambiguous reactions, as we tend to react with a mixture of fascination and fear: fascination with the resources offered and fear about the impacts they can cause us. If currently smart TVs with internet access, video games with motion sensors and network games, notebooks with touchscreen functions and multifunctional smartphones are examples of DICT capable of surprising and astonishing us with regard to the level of technological development achieved, in the 19th century it was the machine system that generated this same ambiguity, causing admiration and perplexity in those who, like Marx (1996), sought to make a more accurate reading of their

time. According to him, the machine is a mechanical monster that fills entire factory buildings and whose overwhelming force, hidden in the subtle movements of its gigantic parts, breaks out in the whirlwind of its countless working organs.

For the philosopher, the machine was crucial for large industry, providing a solid technical base on which it could settle and to have an extraordinary technological advance, producing more and at less cost, but dispensing with a huge mass of workers to do so. Stunned by technological innovations of the time, he states:

The mechanical lathe is the Cyclopean renaissance of the common pedal lathe; the planing machine, an iron carpenter, who works the iron with the same tools with which the carpenter works the wood [...]; and the steam hammer operates with an ordinary hammer head, but of such weight that not even Thor could wield it (Marx, 1996, p. 20).

Marx's words (1996) are full of fascination and astonishment regarding the machinery of the First Industrial Revolution, considered cutting-edge at the time, which led him to investigate not only the relationships, but the means of production, 'dissecting' its *modus operandi*. – the integrated system of machines – and coming to an understanding of its nature. The machine, according to the author, is a technological mechanism made up of three fundamental parts: 1st) a device for generating energy/driving force that drives it (motive machine); 2nd) a system that converts such driving force into mechanical energy (transmission mechanism); and 3rd) an apparatus that transforms mechanical movement into work action (machine tool). Burke (2006, p. 13, *autors emphasys*) summarizes this process as follows:

Being inanimate, the working mechanism, the machine tool, needs to 'come to life', to move. It needs driving force – an engine that gives it the energy to 'live'. But the driving force needs to be properly controlled and brought to the working mechanism, through a transmission system.

For Marx (1996), the major impediment to the development of machine tools before the Industrial Revolution was the fact that the main sources of energy in the manufacturing period were limited to man, horse, wind and water, all with limitations and inconsistencies, so finding a viable solution to the driving force problem was critical, something solved only with the steam engine:

The Watt's second steam engine, the so-called double-acting engine, was the first engine that produced its own driving force was found, consuming coal and water, whose energy power was entirely under human control, which was displaceable and an urban means of transportation [...] its steam engine is not described as an invention for specific purposes, but as a general agent of large industry (Marx, 1996, p. 12-13).

This reveals why the steam engine has become such an iconic feature of the Industrial Revolution, as it was only after the creation of a machine capable of generating driving force (an engine) and, therefore, of being used by other machines, that it could be industrially produced on a large scale, hence its classification as a general agent of large industry, a source of propulsion for the most varied tasks performed by machine tools.

Although genius inventors, such as Watt, emerged to deal with the technological challenges of the industrial age, Burke (2006, p. 14) underlines that "[...] even geniuses, in a way, are products of social transformations". For historian José Jobson Arruda (1988, p. 109), "Inventions made out of social needs were stillborn, as there were no conditions for

their use. Leonardo da Vinci [for example,] imagined the steam engine in the 16th century, but only in the 18th century did it have effective application”.

For Marx (1996), the great ‘evolutionary leap’ of the First Industrial Revolution did not necessarily take place with the steam engine, but with the economic and social relations forged since manufacturing and which led capitalists to make use of the machinery as an effective and incomparable instrument for the production of profit/surplus value, effectively consolidating capitalism as the mode of production of the modern era⁵:

The replacement of tools by machines, human energy by motive force, and the domestic mode of production by the factory system constituted the Industrial Revolution [...]. This transformation process was accompanied by a remarkable technological evolution [...]. It was not just any revolution, but a revolution that took place within the framework of capitalism (Arruda, 1988, p. 106).

The huge evolution in the industrial process led, as if by a ‘cascade effect’, to an intense development of several productive sectors (agricultural, textile, steel, urban, rail, naval, telegraphic etc.), opening space for an also astonishing advance in technologies, science, telecommunications and the beginnings of globalization.

The rapid and exceptional technical development became even more intense in the 20th century, with the Second Industrial Revolution, when the rationalization of production brought about by ‘Taylorism’, the conveyor belt implanted in the production line by ‘Fordism’ and the flexibilization of production proposed by ‘Toyotism’ (‘total quality’ movement) would allow the manufacture of consumer goods on a large scale, lowering costs and facilitating their acquisition by the population, so that this revolution paved the way for, in the second half of the 20th century, the emergence of the era of information technology, which promoted socio-economic changes so expressive that they led to the position of the Third Industrial Revolution.

The Third Industrial Revolution and the nature of the smartphone

For Saviani (2005), industrial development and the relative social balance of the ‘golden age’ of capital (1945-1973) led to a vast transformation in society, which “[...] materialized in a technological advance of such proportion that it gave rise to a new ‘industrial revolution’: the microelectronic revolution, also called ‘computer revolution’ or ‘automation revolution’” (Saviani, 2005, p. 21, authors emphasize). With its foundations in the post-war period, the Third Industrial Revolution only really broke out in the 1970s, decreasing the size of machines and surprisingly increasing their functional capacity, which led to rapid and massive changes in social life.

According to Saviani (2005), the Third Industrial Revolution, unlike the previous ones, is located in the fields of microelectronics and nanotechnology, causing highly complex mental operations to be performed by high-tech devices, with artificial intelligence, making man increasingly dependent on machines. On the other hand, as Rifkin (2014) points out, this revolution also has points in common with the others, as they all promoted the association between new forms of energy production and unprecedented

⁵ The machine generated unprecedented technological development and meant a colossal gain for the owners of the means of production. However, it resulted in a diametrically opposite loss to workers, who had to sell their labor power, witness the growth of unemployment, degrading working hours (including children and women) and the emergence of the relationship of domination and exploitation (Burke, 2006).

means of communication, leading to the junction between energy, internet and the network in the third.

As for energy, the development of increasingly smaller devices adapted to the optimal use of electrical energy was crucial for the expansion of technological markets and the impressive growth of the information technology and telecommunications sectors. As for the internet and the network, there is no doubt that this system has revolutionized more recent times, giving rise to a completely connected 'networked society' (Castells, 2005). Although the post-Fordist society (from the 1970s and 80s) already had information technology and telecommunications resources, speed, instantaneity and globalization (not just industrial, but communication and information) were only really established with the advent of the internet and the shared network. From the 1990s to the present day, the internet has gone from being an expensive and limited resource to becoming a common good, capable of enhancing access to information and elevating the power of telecommunications to levels almost identical to face-to-face.

The energy-internet-network triad paved the way for a rapid diffusion of computerized technology to the most different social segments, enabling the application of this resource on goods and services and broad access to innovations. In the 2000s, computers and mobile phones also left the category of high-cost products to become common goods, which was the basis for the popularization of the smartphone in the following decade.

But why has the smartphone become such a revolutionary device? What are their influences on the process of constitution of the contemporary subject?

To answer these questions, we have to understand the nature of the smartphone, which gained popularity precisely because of its size. The fact that it is light, does not need excess wires and fits in the pocket or in the palm of the hand, made this device much more practical than any other. In analogy to what Marx (1996) explained, we can say that the smartphone, similarly to the steam engine of the first industrial period, also articulates motive machine, a transmission mechanism and a machine tool, but with much more advanced systems and operations.

As for the smartphone's motive machine, something little discussed, but technologically and socially revolutionary, was the development of energy storage cells – lithium batteries. According to Almeida (2015), since the creation of this technological device in the 1970s, it has become increasingly powerful and durable, which has allowed electronic devices to operate for long periods without the need for connection to a fixed point of electricity, expanding its mobility and resources. Thus, the smartphone now has a small motive machine, however, capable of storing enough electrical energy (driving force) to become an instrument of everyday life, having the autonomy and performance necessary for its functions.

Regarding its transmission mechanism, the smartphone has benefited from the creation of ultra-advanced technologies that, even reduced to microscopic sizes, have incredibly increased its capacity and performance. While some machines from the past already occupied entire buildings, such as the ENIAC (Electrical Numerical Integrator and Computer) – one of the first computers in the world, from 1946, which took up an area of 180 square meters and weighed 30 tons (Franzão, 2021) –, the smartphone 'motor' does not require more than a few square centimeters to operate, being constituted by integrated microtechnological electronic units, such as boards, chips, processors, memory cards, in short, a set of small highly capable hardware that, under the command of complex

operating systems, performs similarly or even better than certain computers, both in terms of speed and volume of data processing.

Finally, as for the smartphone machine tool, there are countless possibilities. Currently, there are so many resources available that each user, in addition to having the factory features, customizes their smartphone with the applications they want via the internet. To exemplify such evolution (or we would say, revolution!), a machine of the first industrial age performed only one or a few work tasks: the spinning machine spun; the weaving machine wove! Today, the technological reality is different.

DICTs offer such broad objectification possibilities, that is, multitasking in a single device, that we do not see a correspondence in other machines already created. For the first time, we are dealing with technologies that unite motive machine, transmission mechanism and diversified machine tools in the same unit. It is almost a paradox to explain how such small devices are able to integrate such a large number of features that were once autonomous functions of individual devices, such as telephone, clock, alarm clock, flashlight, camera, video camera, recorder, radio, TV, video games, just to mention basic items that many smartphones have, everything literally in the palm of the hand, not to mention access to the internet and the world that opens up with it, such as information, social networks, games and multiple applications available.

For Queiroz (2018), the smartphone revolution was not born by chance, but is the result of the computer development process. In the 1990s, while PCs already had advanced software to control their functions, called operating systems (such as Windows, Macintosh and Linux), smartphones were only in the creation phase - the first, launched in 1992, from the junction between "Palmtop" and cell phone. Only in 2007, similar technology reached mobile phones, when the iOS operating system was launched by the American company Apple.

Queiroz (2018) points out that, following in the footsteps of the computer industry, the revolution in the smartphone market occurred when Apple changed its focus on its production, focusing more on software than on hardware, that is, more on programs, applications (Apps) and other virtual machine tools than physical parts or transmission mechanisms for the device (some of which were purchased separately and then attached to the device). Obviously, the increase in internet speed and the expansion of coverage for wireless connections were also essential for, in 2007, Apple launched its first smartphone, the iPhone:

The combination of a user interaction system with the device via a functional touch screen and a revolutionary operating system made the iPhone the model to be followed by other smartphone manufacturers. More than that: from 2008 onwards, iOS inaugurated a whole new business model based on 'downloadable' applications, through the launch of an open application store, the App Store [...], the user could enter in a specific app store, from Apple itself, and customize their device with the apps that seem most convenient (Queiroz, 2018, p. 53, authors emphasis).

Therefore, becoming the standard to be followed, the iPhone, with its iOS system and an App Store, was the basis for, in 2008, Google launched a competing operating system – Android –, which broke the monopoly exercised by Apple and allowed several smartphones to appear on the market in a similar way to the iPhone. Android still innovated by not being exclusively tied to a company (since iOS was limited to Apple devices), being able to be incorporated into smartphones of various brands, which led to the cheapening of the product and its transformation into a common good.

The possibility for the user to 'customize' their device, as Queiróz (2018) cites, made each device personal and unique, absolutely personalized and able to be multifunctional, something that, in addition to being unparalleled in history, has placed the smartphone in the position of an amazing diverse tool that invariably acts on the individual's psychic functions, positively or negatively, mediating or guiding their daily activities.

Consequently, the impacts of such a complex and sophisticated machine on the subject's constitution are undeniable. In a vast universe of resources contained in such an accessible, small and portable device, the higher psychological functions tend to undergo considerable transformations as a result of these advances, mainly altering the processes of acquiring knowledge and recognizing reality.

Smartphone: negative and positive impacts to the constitution of the contemporary subject

For Maziero and Oliveira (2016), the increasing diffusion of computerized technologies in society, in particular the smartphone, has led to the emergence of significant changes in customs, habits, social and personal relationships, behaviors and emotions resulting from this interactivity. In the context of capitalism, the smartphone has become, on the one hand, a source of alienation, impoverishment of social bonds and the demeaning of classical forms of knowledge acquisition, and, on the other hand, an object of carrying out multiple activities, of accessing information and communication and intellectual development.

Regarding the negative aspects, Saviani (2005) explains that while the first two industrial revolutions were responsible for transporting manual work functions to machines, replacing man in this process, the third one transfers the intellectual functions to DICTs, releasing us from, in a way, one of the most complex exercises of reasoning. For the author, the 'age of intelligent machines' and the massive incorporation of advanced technologies in society ends up excluding many individuals from the most elaborate activities of thought, harming their intellectual development. As a result, as machines become more intelligent, men tend to alienate themselves⁶, and although new technologies have the potential to eliminate exploratory work relationships, freeing men to fully develop their psychic functions through dedication to arts, science and philosophy, this does not happen because, "[...] from an objective premise to the general liberation of humanity from the yoke of material needs, technological advance becomes, under the social relations of capitalist production, an instrument for maximizing exploitation of workforce [...]" (Saviani, 2005, p. 21).

For many individuals, the misuse of DICTs, especially the smartphone, seems to compromise their potential instead of expanding them, reducing their ability to read reality and alienating them, as we see in the post-truth phenomenon.

According to Zarzalejos (2017), post-truth is not synonymous with lying, but a situation in which objective facts have less influence on public opinion than appeals to

⁶ While the majority of the population (workers) is far from the true cultural goods produced by man, generating mass alienation, a tiny part of humanity (which creates and monitors such goods/technologies) has the development of the psyche impacted by such creations/objectifications (intellectual work of very high complexity), which also guarantees them sumptuous financial gains.

emotions and personal beliefs. According to the author, it consists of relativizing the truth, trivializing the objectivity of data and the supremacy of emotional discourse over journalistic and scientific reporting, causing a kind of 'short circuit' in people's critical and analytical sense. Through sensationalism, memes, conspiracy theories, unfounded historical revisionism and fake news, the once pillars of legitimation of the truth, journalism and science, lose credibility in the face of personal versions (common sense) of blogs, social networks and YouTube video channels, whose contents reach the public directly, without the 'filters' that mark the refined and systematized knowledge.

For Prego (2017), computational algorithms further encourage this process, feeding back social networks and video platforms with similar content and with the same bias to those previously seen by users, creating 'information bubbles', 'unique truths' and loss of contact with the contradictory, the antagonistic and the divergent. This ends up influencing the psychic formation of the subjects, their intelligence and conscience, polarizing the discourses, limiting the debate and generating fundamentalism and intolerance.

The smartphone can also produce negative effects on the psychological functions of sensation and perception, since the technological novelties offered are so attractive to the senses that they remain in the virtual universe, and have access to this web of resources that are opening up in a chain with each 'click' (hyperlinks) becomes something almost irresistible or, as Teruya (2006, p. 82) says, with a very high "[...] power of seduction and enchantment [...]", especially for children and teenagers. This happens, according to Vygotsky (2010), because such a group is not yet able to completely dominate their own behavior and, therefore, depends on mediations so that the external control of behavior can be converted into voluntary actions of self-control.

Maziero and Oliveira (2016) report that from the moment cell phones began to group computer resources – turning into smart phones (smartphones) –, their main function, voice communication, became less used, making maladaptive behaviors associated with the device more frequent, which led to the concept of 'nomophobia'. Of English origin, the term suggests the abbreviation of the expression 'no mobile phone phobia', and refers to the pathological fear of being without the device – a new form of technodependence⁷.

Clearly, the vulnerability of children and adolescents to nomophobia is much greater because, as Vigotskii (2010) suggests, the human psyche goes through a social process of maturation that is only completed around adulthood. In addition, Schwartz (2007) warns that excess external stimuli can harm development because our absorption capacity is limited, causing fatigue and stress if exceeded. The author argues that the multiplicity of choices and the excess of options, evident in the case of the smartphone, can overload the senses and promote a kind of psychic saturation.

This phenomenon, called by Schwartz (2007) the 'paradox of choice', makes individuals feel confused, unhappy and bored even in the face of the vast 'menu' of options the virtual era offers, since each choice implies giving up other alternatives, generating unease, disquiet and the feeling that a universe of options is being left aside. According to the author, this paradox has led many people to permanent dissatisfaction, as the constant search for novelty or for what pleases more and more ends up becoming something unattainable. Perhaps, this helps to explain the alarming rates of psychological distress,

⁷ Technodependence is a term derived from "Internet Addiction Disorder", first proposed in 1995 by the American psychiatrist Ivan Goldberg.

depression, self-injury and suicide among children and adolescents today, as pointed out by Netto and Souza (2015).

For Luria (1979), the intensity, novelty and volume of stimuli can also negatively interfere with another psychic function: attention. In the case of animals, babies and even in certain moments of childhood and adolescence, attention does not occur voluntarily, but in a reflexive, non-directed, involuntary way, as it is not yet fully conscious. In other words, it is the object that attracts the attention of the being and not the being that voluntarily addresses the object, which explains the fascination of babies with colorful drawings, shrill sounds and moving objects. That is why if the stimuli presented to children and adolescents are very intense, varied or attractive, like those present on a smartphone, the question is not whether or not they will want to focus on them, they simply will not be able to deny such psychic appeal (or will have many difficulties in doing so), since voluntary attention also depends on the development of self-mastery of conduct, which can lead both to nomophobia and to a decrease in focused attention on other activities.

For this reason, even though some individuals are more capable of acting in a multifocal way – because, as Santos Neto and Franco (2010) point out, the tendency is for digital natives to have the phone in their ears at all times, while at the same time perform other activities and watch TV –, fragmented attention will rarely be the best alternative, considering that, according to Luria (1979), all divided attention will always imply some loss of quality in attention and perception.

This helps to explain why more recent generations have so much difficulty keeping their attention focused, controlling hyperactivity⁸ and dealing with anxiety, negatively influencing yet another superior psychological process: motivation. In a context of technological revolution, the individual's motivation is almost entirely focused on the use of digital devices that overstimulate them, such as the smartphone, leading them to discredit and even deny less intense activities and with less richness of stimuli, such as household chores and school learning in traditional ways, which become, for the youngest, too uninteresting, demotivating and 'analogous' – in contrast to an increasingly digital world.

However, the possible lack of interest of students does not redeem the school from its role of motivating and educating them. On the contrary, Leontiev (2010, p. 71) states that the study activity, "[...] developing at an accelerated speed under the influence of the school, surpasses the development of other types of child activity". This means that it is the role of the school to produce interest in its activities in students, given that the institution occupies a central position in the transformation of 'only understandable reasons' into 'truly effective reasons' (Leontiev, 2010). In other words, the school must do everything possible so that the merely mandatory activities (stimulus reasons) become voluntary actions (generators of personal meaning), and the new technologies in teaching can greatly contribute to this.

For Barros (2016), with so many options offered by DICTs, subjects get used to constant changes, as they change apps, music, videos, and even worldviews all the time, shaping their perception of reality and their processes of communication using virtual language, which can make them less sensitive to other forms of contact with the outside

⁸ Although there are diagnoses and mass medicalization of children and adolescents with Attention Deficit Hyperactivity Disorder (ADHD), we understand, according to Leite (2015), that difficulties related to focused attention and hyperactivity are not diseases, but deficiencies or behavioral traits that demand the learning of other behavioral and psychic attitudes, not medications.

world, such as 'social-face-to-face' or 'concrete-material', harming affective bonds, and social, family and school relationships:

This is why some call this generation the 'silent generation'. Fast and agile with computers, they have difficulties with traditional school structures and, often, with interpersonal relationships, since verbal communication is hampered by present technologies (Santos Neto & Franco, 2010, p. 14).

In this process, language and learning are other psychic phenomena that can also be influenced by the misuse of smartphones and other DICTs. Santos Neto and Franco (2010) emphasize that oral language was contaminated by globalization and consumption dynamics. The written language, according to the authors, is being reconfigured, with great resistance to the traditional way of reading, so that the book, without the seduction of the image, interaction and effective participation, is becoming obsolete for the new generations, it is common to find teenagers who have never read a book or who have great difficulties in expressing themselves through written language.

Gasparotto and Kliemann (2016) also highlight that more than a generational difference, there are differences in language, in the apprehension of knowledge and in interactivity with people and the world, which brings difficulties to new generations in appropriating content in the same way their parents and teachers learned. In agreement, Palfrey and Gasser (2011) comment that the internet age, in which digital natives are growing, is providing a great change in the modes of communication and acquisition of knowledge, in addition to clear differences in the production of the subjects' identity:

They study, work, write and interact with each other differently than you did when you were their age. They read blogs instead of newspapers. They often meet online before meeting in person. [...] Major aspects of their lives – social interactions, friendships, civic activities – are mediated by digital technologies. And they knew no different way of life (Palfrey & Gasser, 2011, p. 12).

For digital natives, using the smartphone is no longer an option but a constant, a necessity without which they would be isolated, disoriented, which often results in technodependence. Currently, there are many individuals immersed in the virtual world, but without objectifying it, that is, without transforming these experiences into social or singularly useful activities. In general, according to Santos Neto and Franco (2010), the most explored content is limited to the entertainment universe, such as social networks, games and irrelevant videos, dispensing useful activities for life and/or activities that promote humanization, classified by Leontiev (2010) as capable of generating the integral development of psychic functions. These would be the appropriation of sciences, arts, culture, ways of working, human values, notions of civility, discipline, ethics, among others, which do not occur without the participation of mediating instruments in this process.

The limited acquisition of these cultural goods demonstrates that the new generations are not being adequately prepared to transform the vastness of digital resources and information into true knowledge, which results in several problems. For Santos Neto and Franco (2010), the most glaring is the acceleration of technological processes in all fields and the difficulty of digital natives to select useful, adequate and meaningful information, in the face of an unlimited ocean of daily information flows. According to the authors, this imposes on developing minds the serious problem of knowing how to separate 'the wheat from the chaff', of not feeling lost in this infinite web of information and of transforming it into relevant knowledge for the formation of their character and identity.

Faced with profound socioeconomic, cultural and technological transformations, the smartphone has left marks that are clearly expressed in the lives of digital natives, many of them negative, engendering psychic and generational transformations. Freire Filho and Lemos (2008) argue that communicational practices in a regime of simultaneity and convergence make young people live connected to different screens, networks and information flows, which constitutes a kind of 'training' for the harsh changing social and work reality of our days.

On the other hand, fortunately, such influences do not end with the negative aspects, as the technological revolution also produces highly positive and beneficial effects, which make the smartphone a socially worshiped technology, essential to contemporary life.

First, as an example of the positive influence of the smartphone on the constitution of the human being, we can mention its own nature of condensing in a compact and portable object, an enormity of resources that are absolutely useful to our daily life, which help us in several segments, such as education, work, social relations, personal organization, etc. For this reason alone, the smartphone could already be considered a revolutionary technology for human life, freeing us from a paraphernalia of objects and cables and releasing us from carrying various devices, many of them heavy, with us to carry out our activities. All this, now, comes down to a pocket object, which exerts decisive influences on our education precisely because it starts to rely on the smartphone to store fundamental aspects of our existence, such as contacts, photos, documents, access, passwords and other possible content.

Another important point is the positive influence that DICTs can have, especially on some cognitive and affective functions of the psyche. In the same way that such functions can be negatively affected by the misuse of these tools, their good use has great potential to promote the opposite effect, improving the intellect as a whole (Santos Neto & Franco, 2010). Costa et al. (2015) emphasize that DICTs can and should be used as mediating tools for learning, including in schools, being able to sharpen curiosity, imagination, emotions and forms of language, and can also collaborate in the subjective constitution and in the autonomy of subjects.

Moreover, we can add a number of other benefits that the smartphone is able to provide when properly used, whether through games, work tools or specific applications, such as increased acuity and visual perception; improvement of focused attention (unifocal) and divided attention (multifocal); increased reaction speed; growth in quick thinking and decision-making skills; expansion of memory and intelligence; and increased general cognitive ability. For Santos Neto and Franco (2010), many students with difficulties in appropriating knowledge through traditional ways are incredibly intelligent, however, they create fabulous things using music, images, drawing, in short, a multimedia language.

In this way, it is evident that the smartphone is a powerful human instrument, which breaks down into several others and may be able to perform the most varied functions. Vigotski (2004), in his 'instrumental method', teaches that while the technical tool is placed as an intermediary between man and nature, giving us the possibility to transform it according to our needs (through work), the psychological instrument is placed as an intermediary between man and the concrete object or phenomenon, giving us the condition, through memory and through the act of thinking (instrumental act), to register and mentally operate with that object/phenomenon without it being materially present at

that moment. In summary, it is basically a virtual operation, the foundation of all the features present in a smartphone, which operate simulating concrete reality.

This is why the smartphone has such relevance in the constitution of the contemporary subject, as it is both the simulacrum of various technical tools and the various real mental operations necessary to operate them, modifying our psyche.

Final considerations

There is no denying that the smartphone, with its complex and extraordinary nature, the product of technological-industrial revolutions that have taken place from the steam engine to the present, is a factual reality capable of benefiting various areas of human action. However, as has been evidenced in capitalist relations, this tool is often taken as a consumer good, not as a cultural good historically produced by man (Leontiev, 1975), which limits its positive and humanizing potential.

In this way, dialectically recovering the historical course of technological creations is a way of guaranteeing psychology a broader spectrum of analysis, allowing a better view of the relationships that culminated in constituting in today's society something that we seek to do in relation to the microtechnological revolution and the emergence of the smartphone, a technology that requires from us a critical and ethical perspective for everything that can impact the relationships between subjects and the development of their psychic processes.

In unequal conditions of access, education and appropriation of new technologies, problems related to the small development of human intelligence occur and are perpetuated by the non-conscious or alienated use of these tools, causing technological advances, instead of producing intellectual and human development, to cause harmful effects, such as nomophobia and technodependence, distancing from 'face-to-face' relationships, fruitless use of DICTs and increasing digital divide, exposing the challenges to be overcome.

Leontiev (1975) explains that each generation appropriates cultural wealth by participating in work, production and forms of social activity, thereby developing specifically human skills and characteristics, which makes the smartphone a tool at the service of humanity and humanization. Nevertheless, as Santos Neto and Franco (2010) warn, if its use occurs inadvertently, alienated or just for entertainment purposes, escape from concrete reality or consumerism, then it becomes a mutilating force, which degrades the human being instead of emancipating them.

Due to such contradictions, we understand that there is a need for further studies so that we can broaden our understanding of the constitution of the contemporary subject and the influences, positive and negative, of DICTs, especially the smartphone, on the human psyche. It is important, above all, that we make a commitment to fight for the socialization of this instrument, encouraging the conscious and responsible use of this cultural asset and encouraging the objectification and use of this tool in socially useful activities, something indispensable to have a true society that is not only of information, but of knowledge.

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