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Vygostsky and the Cyborg

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Abstract

The introduction of new technologies in FL teaching has increased the need for a robust theoretical approach with sufficient explanatory power to account for three aspects in the area: (1) define tools to be used for a given objective, (2) situate tools in the learning community, and (3) describe tools from a historical perspective, including past, present and future. The purpose of the paper is to argue that a focus on tools, seen as mediational means to reach an objective, helps us to better understand how language teaching has evolved up to now and prepare us better for what we can expect in the future, including a post-human era. The paper describes how Vygotsky's initial ideas on mediation naturally develops into the concept of functional organs, as the merging of body parts with external objects, and how this merging eventually leads to cyborgization, seen as total fusion between human and artifact, including integrated circuits that can be internalized. The conclusion is that FL teaching is a technology-intensive area and can draw on alternative disciplines, from Social Psychology to Literary Criticism and Feminism, for theoretical support and insights on the role of technological mediation in pedagogical practices.

Keywords: Activity Theory; Cyborg Theory; Functional organ; CALL; Cultural artifact.

1. Introduction

The objective of this paper is to reflect on a possible connection between Vygotsky' ideas and the Cyborg Theory (Haraway, 1991). Vygotsky's ideas are used for its emphasis on the mediational process, seen as a critical issue in human learning, and fundamental to the development of Activity Theory, as proposed by Leontiev (1981) and developed by Engestrom (1999). Wertsch's (1998) ideas on the extended

mind and Cole's (2003) on cultural psychology are also relevant. In terms of the Cyborg Theory, it is suggested that humanity is moving to a post-human era, leading to a symbiosis between human beings and cultural artifacts, as anticipated by Haraway (1991).

The paper is organized in three main parts. In the first, I try to explain the functional organ theory, based on a Vygotskyan/Leontievan perspective, and its impact on contemporaneity. The idea is that with tool appropriation by the subject, there emerges such a close relationship between tool and subject that it becomes difficult to separate one from the other. Although Activity Theory is not openly referred to along the paper, my affiliation to it is clear as I describe the role of tool mediation between subject and object. In the second part, I introduce the Cyborg Theory, seen as a natural extension of the functional organ theory. The symbiosis is no longer between a part of the organism and the external object; it is the whole subject that blends with the artifacts in the environment. The psychological effect of object personification is also discussed. Finally, in the third part, I try to show how functional organ theory and Cyborg Theory are related to language use and language teaching. I emphasize the way tool appropriation can lead to tool invisibility. The issue of resistance to the introduction of new technologies is also approached.

This is a speculative paper. Its greatest ambition is to help understand learning in the post-human age we seem to be entering. It is anchored on Vygotsky not to explain his ideas, but to use his ideas to explain learning mediated by the new technologies. Although speculative, it is based on years of classroom practice in language teaching.

2. The developmental of functional organs

Human beings grow and learn by interacting with the environment in which they live. Those who live in a farm will probably learn to ride horses, steer cattle, and possibly tell cowboy stories. In the same way, those who live near the ocean will learn to fish, ride boats, and possibly entertain tourists with fisherman stories. There is always a compatibility factor, which may be greater or smaller, between what the person learns and the resources available in the environment. Nobody will be able to ride a canoe on troubled water unless canoe and troubled water are available.

Learning does not occur in a vacuum or solely through the individual`s internal resources. Support from external resources is necessary so that individual can change internally and learn.

The relationship that emerges between the individual and the resource that is used becomes closer with learning. In the beginning, the relationship between rider and horse, for example, may be seen as an encounter of strangers, two elements separated from each other, functioning independently. As riding skills develop, however, rider and horse become one body, to the point that it is impossible to distinguish one from the other; the mythological figure of the centaur may be seen as the result of this fusional process. In all human activities – be that in the world of sports, arts or employment – the greater the mastery of the individual over the instrument, the closer the relationship between them. A consummate violinist, playing an elaborate musical piece, is so close to the instrument that it becomes difficult to see where the player ends and the violin begins; the music that is produced surges from both at the same time. A cyclist, running and jumping in a Mountain Bike circuit, is so integrated with the bike, as it jolts up and down, that terrain irregularities are experienced directly by the body.

Where lies the border between the individual and the external world? On which side lies the violin in a musical concert or the bike in a Mountain Bike circuit? On the individual`s side who learned how to play the instrument proficiently, on the audience side that attends the performance, or somewhere between the individual and the audience? The idea is that the instrument, with practice, integrates with the body. The violinist`s internal world does not end where the violin begins but where it ends. On acquiring mastery of the instrument, the borders of the internal world are enlarged and end up by including the instrument itself, like the blind man in Bateson`s (1992) example:

> Suppose I am a blind man, and I use a stick. I go tap, tap, tap. Where do I start? Is my mental system bounded at the hand of the stick? Is it bounded by my skin? Does it start halfway up the stick? Does it start at the tip of the stick (p. 459)?

The fusion that occurs between an organ in the body and the instrument (arm and stick, for example), not only magnifies the action of the organ (arm), but ends up

by creating a new single organ, which Kaptelinin (1996), based on Leontiev (1981), refers to as “functional organ.” A functional organ develops when any internal resource in our body associates closely with any external instrument to carry out a given task in an integrated fashion. It involves body organs such as eyes, hands or ears, forming dyads with external instruments and functioning as one organ: it is the case of the glasses that integrate with our eyes to improve our sight, the hammer that magnifies the power of the hand, the ear prosthesis that enables us to hear what is beyond our aural reach. Functional organs are also developed from the fusion of external resources with superior mental functions such as memory, attention, thought and emotion, among others. It is the case of the abacus, which facilitates arithmetic operations; writing, which amplifies memory capacity; the electronic sheet, which accelerates the development of a project; and so on.

Instrument diversity amplifies functions not only in terms of variety, but efficiency as well. The hand, united to an external resource, carries out tasks that were previously unfeasible: chopping wood with the help of an axe, nailing boards with a hammer, opening a trench with a shovel. Things are also done more efficiently: time spent to build a bridge, dig a tunnel, or harvest an acre of corn is extremely reduced with the use of appropriate machinery. Tool diversity enlarges the possibilities for each organ in the human body. The eyes, for example, may use glasses to increase the definition of objects, binoculars to approximate what is distant, microscopes to enlarge what is minuscule, telescopes to gaze at the stars. Diversity not only increases the capacity of the organ in performing its function (the hand digs the ground better and faster with a spade), but also leads to the creation of new functions (we learned to fly with the birds but went beyond, going through the stratosphere and reaching the Moon).

As higher mental functions are considered, advances with the use of tools are also easily noticed. Statistical computer programs are able to analyze, in a fraction of a second, data that previously took months to be computed, including procedures that were not even thought of as possible. Project management systems are able to present almost simultaneous results, allowing for innumerous simulations until user`s needs and preferences can be met in all details. In terms of text, billions of documents, scattered over the Web, are available to the reader: from the complete works of Greek

philosophers to restaurant menus in any neighborhood; everything easily accessible with the help of search engines, which allow us to find exactly what we want, organized by topic, author, word, or image. We can say that all this facility is the result of the technology we use, but the word technology may be too vague here; in fact, we are using concrete tools created by some people. When we acquire mastery in using them, we create a functional organ between this tool, lying outside, and a mental function, which is inside us.

With technology evolution, some tools migrated to the inside of our bodies: there are people who have valves in their arteries, platinum pins in their bones to fix fractures, pace-makers to control their heartbeats, and so on. With nanotechnology development, microscopic robots, the size of a bacteria, are projected to be injected in our blood stream and perform tasks such as collecting data from our body, destroying cancer cells, correcting aneurysms or fragmenting kidney stones.

This symbiosis between human beings and machines affects body and mind. The same way as the frequent use of dumbbells can change an athlete`s muscles, the continuous use of an abacus will affect our mental skills in mathematics. The transformation provided by the tool is both physical and mental. Increase in our muscles as a result of exercise is clearly visible to the eye, but the internal changes that occur in our mind, although less evident, can be equally notable. As these more or less visible changes occur, people change the way they act and think; not only those who use the abacus think differently from those who use a calculator, but they also think differently from those who use dumbbells. The idea that we are modified by external conditions, including the tool we use, is not new of course. Let`s see, for example, what Vygotsky said in a text that was originally published in 1929:

> The inclusion of a tool in the behavioral process (…) modifies the course and the various aspects (…) of all mental processes included in the instrumental act, replacing some functions with others (Vygotsky, 1981, p. 139-140).

Nowadays, the fusion of human beings with machines is more impressive because of the accelerated development of the new technologies. We are no longer dealing with analogical tools, connected to the muscles or organs of the body, but with digital tools, reproducing reality, and connected to mental processes such as the

ability to relate, conceptualize, define, deduct, summarize, understand, etc. It is probable that the impact of these digital tools is even greater than with analogical ones. Current facility to access information, for example, should affect the way we construct knowledge, possibly faster, more selective, and more relevant to our specific interests. Regardless of our beliefs in conscious control of our lives or in colonized minds, choice opportunities are now much greater than they were before. Today we are more able to choose what we want to learn, rather than being submitted to what other people want us to learn. The tools we have make us stronger and swifter, not only physically but also mentally.

The development of a functional organ, which occurs by integrating external and internal resources, goes both ways: outside in and inside out. Again, this is not new, but it became more relevant with the introduction of the new technologies: it is not only the world that changes us; we also change the world, producing new tools and improving them. Intelligence ceases to exist as an exclusive function of the human brain, stored within the skull, but spreads on the artifacts that surround us, including search engines in the Internet, electronic sheets, word processors, etc. According to Clark (2003), what distinguishes human intelligence is its capability of interacting in a deep and complex way with non-biological objects, placed outside the limits of the human skin. The human mind does not necessarily need biological support to exist or to exist only on it; it can extend to other non-biological supports, such as central processing units, random access memories, or digital networks that cover the planet. Still, according to Clark (2003), we created such an intelligent world that we can take our brain to places where no other animal brain has been able to get before, in a way that we mix together with the artifacts that surround us. “As our worlds become smarter and get to know us better and better, it becomes harder and harder to say where the world stops and the person begins.” (Clark, 2003, p. 7).

The idea that our mind extends to the tools that we create is also endorsed by Australian philosopher Neil Levy (2003), on claiming that we think with and through the tools that we use. Our memory is not only inside our brain, but also outside it, from the time we created writing. Once again, it is difficult to perceive the border that separates the internal from the external world, because human mind is the product of technological scaffolding. Clark’s central thesis is ratified: “The unadorned brain is

just not all that impressive: it is the world of tools and props with which we surround ourselves which makes us so smart" (Levy, 2003:14).

In the Cartesian tradition, the subject/object dualism separated mind from matter. In Charlie Chaplin's modern world, the separation between man and machine is still maintained ("You are not machines. You are not cattle. You are men"). In the post-modern world, the separation is no longer held, either in Descartes' epistemological terms or in Chaplin's romantic appeal. In terms of the functional organ proposal, we find that, essentially, we are neither just machines nor just human beings: we are both human beings and machines.

What is inside us is outside and what is outside is also inside. We have in our cells the same chemical substances existing in the universe, including iron, zinc, acids, carbon, etc. The skin that wraps us is a porous layer; it does not retain what is inside us and it does not prevent us from absorbing what is outside. We are not loose parts in the universe; we form an integrated circuit with the world that surrounds us. We are complex systems which react physically and mentally with our surroundings. We put on weight with excessive eating, thin out with fasting, learn by interacting with the artifacts around us, and forget our appointments if we leave our diary at home. The ton of air that weighs on our heads does not crush us because we have equal pressure inside ourselves. We are not a closed world inside another and we do not have a shield to protect us. We are totally vulnerable, traversed by things existing in the world. We have no walls to protect us and we are not prevented from going through them. We are ghosts.

2. Cyborg Theory

We can see the relationship between human beings and their surrounding artifacts under an evolutionary perspective, characterized by three stages. In the first stage, the relationship can be described as an exclusive organic symbiosis: the hammer as an extension of the hand. In the second stage, we find that the relationship can also be mental: writing as a surrogate for memory. Finally, in the third stage, we see the artifact as an interactive element, holding some subjective features. That's

where emerges, in a more clear way, the idea of cyborgization (Haraway, 1991; Silva, 2000; Kunzru, 2000; Warwick, 2002; Kim, 2004; Turkle, 2005).

The organic symbiosis between the human being and his or her surroundings is as old as humanity itself. It is already present, as mentioned before, in the mythological figure of the centaur, fusion of person and animal, with Icarus, fusion of person and object, trying to fly with a pair of wings made of wax and feathers. Both Centaur and Icarus are based on an organic prosthesis, as physical extension of the body and visible to the eye.

With the invention of electricity, and later with the introduction of microelectronics, we have realized that, besides an organic physical prosthesis (hammer as extension of the hand), there is also a mental prosthesis, in which certain objects function as an extension of the brain. We are surrounded by tools that expand our cognitive capacity. McLuhan, in the 1960's, already assumed this cognitive point of view when he claimed that "[w]ith the arrival of electric technology, man extended, or set outside himself, a live model of the central nervous system itself (McLuhan, 1994, p. 43). There is a transition here that goes from "an organic, industrial society to a polymorphous, information system (Haraway, 1991, p. 162). It should be noticed that it is only the perception of this mental prosthesis that is recent; the use of tools as an external annex to the brain exists from the beginning of civilization. "We have stored our memories outside the brain from the time we invented writing; we have amplified our mathematical skills with the use of tools since we have learned to count with our fingers" (Levy, 2003, p. 14).

Finally, in the third moment, we perceive that we can interact with machines as if they were social actors: "living things and machines are not essentially different" (Kim, 2004, p. 206). Wiener, in 1950, seemed to anticipate this new relationship when he claimed that "We have modified our environment so radically that we must now modify ourselves in order to exist in this new environment" (Wiener, 1950, p. 46). There is an interesting implication in Wiener's words: if we do not master the tools that surround us we will stand at the margin of history. We are only as good as the tools we use.

The changes we have to introduce in ourselves may be a little frightening. Wiener himself has warned us that machines will not be just obedient slaves, filling up the future with unthought-of possibilities for human beings; they will impose constraints, new ways of thinking and new competencies, some of them not easily acquired:

> [T]he future offers very little hope for those who expect that our new mechanical slaves will offer us a world in which we may rest from thinking. Help us they may, but at the cost of supreme demands upon our honesty and our intelligence. The world of the future will be an ever more demanding struggle against the limitations of our intelligence, not a comfortable hammock in which we can lie down to be waited upon by our robot slaves (Wiener, 1966, p. 69).

The idea of machine as a social actor gets clearer with the concept of cyborgization, although not less frightening:

> On one hand, mechanization and electrification of the human being; on the other, humanization and subjectivization of the machine. It is from the combination of these processes that the post-human creature we call cyborg is born (Silva, 2000:14).

The concept of cyborgization seems to be present in all aspects of contemporary life, be it on identity studies in Psychology, in literary essays, in imaginary fictional creations, in different prosthesis experiments, or in educational proposals, including language teaching mediated by the new technologies.

We do not use technology solely to create new virtual identities: imagining a second life, simulating other possible worlds, interacting in RPGs, creating avatars, using nicknames, etc. We apparently see technology as a psychological reality, outside us, constituting a second identity, with which we interact in the same way we interact with people. Turkle (1005) studied how children, teenagers, and adults treated machines. He found examples of children playing video games and accusing the machine of cheating them when they could not win. Other examples could be mentioned such as teenagers mentally involved with strategies that they have to develop to go on playing; or even hackers, seen as a new type of romantic ideal, no longer trying to integrate with nature but with the machines. Computers take on a new

identity when interacting with us and end up by changing the way we organize our thinking and interact with objects.

In literary criticism, N. Katherine Hayles, author of books with intriguing titles such as “My mother was a computer” (Hayles, 2005) and “How we became posthuman” (Hayles, 1999) explores the idea that humanity will end up becoming cyborgs. With the advance of technology, we will stop being humans and evolve to a digital state in which all we feel and think can be discharged to objects outside our bodies, existing as epiphenomenon. Writing loses its original human traits: more and more we know less and less if what we read was written by a human being or by a machine, including many e-mails we receive, produced by computer scripts. The cyborg, as post-human, has nothing in common with the illuminist subject, owner of his or her own consciousness, rationality and free will. He or she is a divided subject, whose intelligence resides both in the brain and on different intelligent machines outside the human body. Today, for example, when we produce a text on the computer, be it an e-mail, a report or this very text I am writing now, we are constantly assisted by the machine, aligning the words on the page, suggesting spelling, offering synonyms, etc. Text authorship is lost somewhere between man and machine.

But it is Dona Haraway, with her Cyborg Manifest (Haraway, 1991), who became a reference in Cyborgization studies, literary criticism and feminism. With Haraway, the fusion is not only with human beings and machines but also with animals. We live in a moment of hybridism between machine and organism. The romantic idealism of integration between human beings and nature, as revelation and promise of innocence, does not exist any longer. We do not come from dust and we cannot dream of returning to dust. Now we are cyborgs, integrated to microelectronic devices, visible and invisible:

> Our best machines are made of sunshine; they are all light and clean because they are nothing but signals, electromagnetic waves, a section of a spectrum, and these machines are eminently portable, mobile (…) Cyborgs are ether. (…) Engineers are sun-worshippers (Haraway, 1991:153).

The borders between human beings, animals and the artifact we use cease to exist. We all form an integrated circuit with machines, which are everywhere, visible and invisible.

It is obviously in the fictional world where the presence of the cyborg is more evident. There is a long standing fascination for hybrid figures, from ancient mythologies to present-day fiction, including the Assyrian winged bull, the Pegasus from Greek mythology, and Captain Hook in Peter Pan. Comic strip literature is full of characters capable of transforming themselves into monsters, ferocious animals, spider men, and so on. In movies and television, some figures are also worth mentioning, including well-known characters such as Darth Vader and Robocop, along with earlier characters such as Steve Austin, the bionic man from the television series "The six-million dollar man" and the feminine counterpart, the Bionic Woman. They can be both good guys and bad guys. Darth Vader is the prototypical villain, but Robocop, the future cop, is introduced as the champion of public well-being, fighting against the inexcusable interests of the big companies. Some are closer to flesh and psychological nature: Darth still keeps intact memory of past deeds. Others are closer to physical nature and cold metal: Robocop had his memories erased from his brain; little has remained of his earlier human nature, biological as well as psychological. The longer or shorter distance from earlier humanity, however, has nothing to do with cyborg ethics. Darth Vader, the bad guy, had more flesh and human memories than Robocop, the good guy, with more metal in his body and integrated circuits in his brain.

In real life, as well as in fiction, cyborgization also develops with the advancement of technology, imposing fusions, on one hand, but also creating greater diversity on the other. Once again, life imitates art. In a world without borders between memory and matter, there are also no borders between fiction and reality. We are becoming more and more diversified and have to learn how to live with this diversity. We are beyond those traditional differences between race, color, or religion. We now have differences in relation to people with special needs, visually-impaired or with hearing loss. In fact, we go beyond that: we have differences with users of different cell phones, orthodontic devices, respiratory machines, pace-makers, and so on. Cyborgization enlarges differences.

We can use prostheses from different materials to enhance the beauty of our body such as lenses to change the color of our eyes, silicone fillings to enlarge breasts, mascara to highlight eye brows, moisturizers to improve skin freshness, press-on nails to embellish our fingers. Besides aesthetical aspects, prostheses are also used to recover organs that have been lost or remained undeveloped. In fiction, Captain Hook replaced his lost hand with a hook. In real life, we have gone further. According to news published by the *Washington Post* on September 14, 2006 (Brown, 2006), a woman who lost her arm in a motorcycle accident can now grab things with her bionic arm, with movements controlled by thought. The best known case is that of Stephen Hawking, a victim of amyotrophic lateral sclerosis (ALS), a neurodegenerative disease that leaves patients almost completely paralyzed. Although he is unable to move and talk, Hawking is the author of several books and a speaker in many events – using a wheelchair and a voice synthesizer connected to portable notebook and controlled by his head and eye movements (Hawking, 2007).

Although we have traditionally separated fiction from reality, in terms of cyborgization, there seems to be little difference between one and the other. According to Haraway: "…the boundary between science fiction and social reality is an optical illusion" (Haraway, 1991, p. 149).

3. Cyborgization and language teaching

Any instrument, be it technological such as a pencil or a computer, or psychological such as language or thought, is always a mediational device between subject and object. Our interest in acquiring mastery over a given instrument is not in the instrument itself, but in the objective we intend to achieve through that instrument. Whenever someone uses a pencil or a computer to write someone else a message, interest is neither on the pencil nor on the computer but on the message to be written. Considering that tools demand an initial learning period to be used efficiently, attentional investment may be demanded from the subject at that early stage of mastery acquisition. When a child starts learning to write, attention is required on how to grab the pencil, how much pressure should be exercised against paper, how to move it around, etc. It is only when the child forgets the pencil and is able to focus

solely on the intended message content that he or she has learned to use it. As soon as we learn to write the pencil gets invisible.

This same learning curve is also valid for more complex tools such as computers, for example, including, in this case, the ability to synchronize keyboard and mouse movements, to move paragraphs around on the monitor screen, to save periodically the text that is being written, etc. All these actions, disconnected and time-consuming for the user in the beginning, evolve to an integrated and single activity, expeditiously carried out by the user after a period of practice.

The same way as language apparently becomes simultaneous with thought, blending with it, the act of writing is equally simultaneous with language, merging with it through the use of the instrument, which ends up by disappearing with the merging process. As soon as we learn to use a computer, it also gets invisible.

Pencils and computers are examples of technological tools in which the evolution of a learning automatism, from visible to invisible, is more easily noticed. The same evolution, however, also occurs with psychological instruments. When we speak a language fluently, it becomes invisible as a mediational tool. We are totally unaware of phoneme production, subject/verb agreement rules, or sentence word order arrangements. Everything is produced in a continuous flow, below consciousness level. People who have read similar texts in different languages are usually unable to tell in which language they read a given bit of information. Language becomes invisible when we learn it. The fate of any instrument, whether technological or psychological, is invisibility.

Pencils, books, computers, Internet, etc. are cultural artifacts related to language use. They need to be ontogenetically internalized, automatized, invisibelized, ultimately naturalized by the individual in the appropriation process of the different textual carriers that are available in contemporary cultures. This appropriation process, consummated with invisibelization, is another example of cyborgization.

No matter how hard education has resisted the introduction of new technologies, either for lack of funding or teacher unpreparedness, cyborgization always ends up by affecting teaching, mainly in the area of language learning, where the impact seems to

be greater. Language teaching has always been an area distinguished by intensive use of technology, both in the case of first (L1) and foreign languages (L2). For decades, L2 teachers have used tape recorders, slide projectors, radio and television, not to mention even older technologies such as flannel boards, posters and flashcards. In L1, teaching and schools can only justify their existence because of the support provided by technology to language, be it the form of books, newspapers, magazines, the classroom chalkboard, or the notebooks where students write. Because they are traditional textual carriers they have already been invisibelized as technology, but they continue to exist in the physical world and have to be learned by the child to be able to interact with the surrounding social world.

With the advent of computers, language has acquired a new textual carrier with the result that now not only children, but adults from the pre-digital generation as well, have to learn how to use it, with or without enthusiasm for its pedagogical possibilities. The high volatility of computers, always evolving faster than people's capacity to learn how to use them, in opposition to the stability of books, for example, may have contributed to arouse resistance on the part of many teachers: as they hardly get familiar with an operating system, a new one is introduced. When the computer stopped being an isolated artifact on the table, as is the case of book, for example, and was connected to other computers, giving rise to a net of interconnecteds machines, capable not only of producing but also of exchanging information, and creating Internet as we know it, interest for the new textual carrier has increased. Now it is possible to have immediate access to texts and interlocutors in any part of the world. The L2 student can interact online with target language speakers through the innumerous resources available in the Web.

Although historically L2 teaching has sometimes been a victim of certain technologies, introduced in the classroom for the purpose of serving the financial interests of big companies more than educational interests, as was the case of language labs, for example, quoted ad nauseam by those who censor any innovation attempt – even so, it is not possible to separate language use and teaching from information and communication technologies. These technologies were created because of language and they exist to serve it; radio, telephone, and even television, among other information technologies, were created because people talk. Conversely,

people talk, hear, write and read, and do it all more intensely, because information technologies were created. A person with a cell phone talks and interacts more than a person without it, probably even more than he or she would like to. Technology feeds language and language feeds technology, following a recursive procedure. The relationship between language and technology may escape the attention of some educators, but not the financial interests of many companies that have invested heavily in the area, as is the case, for example, with telephone companies. Financial possibilities are often more quickly perceived than educational ones. The language lab may not have worked, among other reasons, because teachers refused to learn how to use it and did not bring their pedagogical expertise to produce the required teaching materials needed for the machine to function properly.

Digital diversity in today's world goes far beyond the analogical simplicity of the time language labs were used, a time in which technology implied high costs and produced low returns, thus making it easy to be rejected. A language lab used a whole room, filled with equipment that broke easily, increased the electricity bill, and was tied to the furniture. Today, technology is dynamic, mobile, miniaturized in integrated circuitry. What filled up a room then, today can be carried in a shirt pocket, including not only audio, but also text and video, at such a low price and high benefits that it is much more difficult to be rejected. A single DVD, for example, may store the equivalent of 1,000 books – at a cost that is lower than one tenth of the cost of one book, considered the material used in its production.

Besides the low cost of digital technology, which popularized its use, there is also a great diversity of artifacts, which some censors derisively insist on referring to as electronic paraphernalia, but which carry the possibility of extending various functions of the mind that are relevant for language learning in the cognitive, affective and psychomotor domains. We not only see and hear more and better, but we also learn more and better as new mediational instruments expand and improve contact possibilities with the world, bringing high definition images, clearer sounds and information that is more relevant to our personal interests. We can reach further and more easily find exactly what we want, not what other people want us to find, way beyond the highly selected and truncated materials that the daily newspapers impinge on us to be read at breakfast time.

Besides traditional technologies that have characterized language teaching such as radio, television, videotape, DVD, tape recorders, etc., others have emerged, storing audio and video in devices that are becoming smaller, more portable, and closer to our body. Portability has always been an undeniable asset for small devices such as pencils and pens, but today computers can be as portable as pencils. In the old days, people used to walk to a television set; today we carry the television set with us, contiguous to our skin. It is now possible to have eyeglasses projecting stereo images directly into our retina. This growing proximity with the artifact is naturalizing cyborgization, not only in terms of entertainment, but in terms of language teaching as well, as seen with the proliferation of MP3 players, iPods, and a whole set of interactive technologies.

4. Conclusion

Human beings are complex systems. They have a high degree of vulnerability to the environment in which they live, allowing themselves to be modified by what happens around them and, at the same time, modifying this same environment. The interactional process that produces these mutual changes works in three directions: with other human beings, with the animal kingdom and with cultural artifacts.

Human beings always felt the need to imagine themselves integrated with nature, projecting into the natural world what they felt in their souls or seeing themselves invaded by what happens in nature, from tropical storms to murmuring creeks descending rocky hills. Romantic literature, for example, is filled with long descriptions of cheerful sunrises and melancholy sunsets, as reflections from the soul. It is as if a human being were transformed into a searchlight, capable of projecting images outside, on the clouds, like the bat in Batman's Gotham City. The romantic imaginary encapsulates it all: the human being is the size of the universe, brimming over it and filling it with what is inside, joy or melancholy. On the other hand, the human being also captures what is projected from the outside, like a camera with a focal point where images from the universe are concentrated. Metaphorically, it is as if we were at the same time a projector, sending off images to the world, and a camera, capturing these same images. There is a close integration with nature, usually seen as a healthy blending (the good savage in Rousseau’s terms).

The merging of human beings with animals takes interaction a step further, binding a closer tie . What was projection in the integration with nature (soul feelings projected on the landscape and vice-versa), becomes mutual symbiosis with animal integration: human body with a bull head (Minotaur) or horse body with human trunk and head (Centaur). Beyond symbiosis, there is also a projection of human traits on animals (such as speaking, for example), not only in fiction but in real life as well. In fiction, we have the fables, still traditionally located in the time that animals spoke and acted like people, besides more contemporary versions such as the innumerous characters in books, movies and cartoons (Donald Duck, Mickey Mouse, Bugs Bunny, Tom and Jerry, to mention only a few of the most popular). Similarly, in real life there is also an anthropomorphization of animals, from children who play with and talk to them to adults who give them proper names, dress them and tell them what to do as if they were human beings.

But it is in the interaction with cultural artifacts, that cyborgization really occurs, as a result of the idea that mental functions and body organs can form a functional unit with artifacts produced by a given culture. Anthropomorphization of objects is also possible but not as frequent as it happens with animals. With the exception of toys, which traditionally can act as humans (Tin Soldier), the anthropomorphization of objects seems to be a more recent phenomenon (SpongeBob). Finally, there is a natural resistance against the blending of subject and object, apparently still bringing with it some residues of Rousseau's philosophy. What culture produces is inorganic garbage that corrupts human beings and pollutes the natural environment, exactly because of its resistance to decay and return to nature. An iPod, with its stainless components, does not deteriorate, like trees and animals, that are turned into nutrients to survive into other plants and animals. An iPod becomes permanent waste in the universe; because it did not come from dust, to dust it will not return.

The possibility of a post-human civilization, implied in the Cyborg Theory, does not necessarily mean dehumanization, as might be suggested by a possible neo-Rousseauan censor. Technology also humanizes, providing not only arms to those who lost them, but also voice to those who cannot speak, as is the case, for example,

of Stephen Hawking and other ALS patients. Notice, by the way, Gail's testimonial, an ALS victim.

> I now sit at my computer an average of 35 hours per week! I absolutely love it. I can't utter one intelligible word so I find great solace in knowing that I have some way to communicate. Without my computer I would probably go crazy because I have the insatiable desire to be understood (Gail, 2007).

Starting from a Vygotskyan perspective, we can see that cyborgization occurs with the use of certain cultural artifacts, from a pencil we hold between our fingers to the nanorobot we inject in our bloodstream, all of them seen as mediational tools between subject and object, even if they are placed inside our bodies. These tools can transform, not replace, the subject; there will always be a domain reserve that constitutes the subject, no matter how fragmented we may be, or how closely attached we are to a given tool. Human attachment to a tool does not reflect surrender but human mastery over it. When we use any instrument, either psychological like language or technological like the classroom chalkboard, it is not us who disappear, but the tool we use. Gail, in the quote above, is not replaced by the computer; no matter how dependent she is on the machine, she uses it just as a mediational tool to get to other people. There is no hierarchy between subject, mediational tool, and the object in a given activity; all are equally important to get the activity accomplished. Gail may be so competent in the use of the machine connected to her body that the interlocutor forgets its presence in the conversation. Even so, the conversation will be maintained only as long as the machine is functioning, whether or not interlocutors are aware of it. This need for instrumental mediation, however, does not diminish the importance of the subject; quite the opposite: it is through it that the subject acquires visibility. Cyborgization, as a mediational process between the subject and the world, gives us a chance to expose ourselves to the world either as we are or as we would like to be, as good or evil avatars, Darth Vader or Robocop.

References

Bateson, G., 1872. Steps to an ecology of mind: a revolutionary approach to man's understanding of himself. Ballantine, New York.

Bergson, H., 1994. Matter and Memory. Zone Books, New York.

Brown, D., 2006. For 1st woman with bionic arm, a new life is within reach. Washington, Washington Post, p. A01, [14 September 2006].

Clark, A., 2003. Natural-born cyborgs: technologies, and the future of human intelligence. Oxford University Press, Oxford.

Cole, M., 2003. Cultural Psychology: a once and future discipline. The Belknap Press of Harvard University Press, Cambridge, MA.

Daniels, H., 2001. Vygotsky and pedagogy. Routledge, London.

Engestrom, Y., 1999. Activity theory and individual and social transformation. In: Engestrom, Y.,Miettinen, R., Punamaki, R. L. (Eds.), Perspectives on Activity Theory. Cambridge University Press, Cambridge, pp. 19-38.

Gail., 2007. Thank you letters [online]. Available: http://www.voiceforjoanie.org/note3.htm/ [26 January 2008].

Haraway, D., 1991. Cyborg Manifesto: science, technology, and socialist-feminism in the late twentieth century. In: Haraway, D. (Ed.), Simians, cyborgs and women: the reinvention of nature. Routledge, New York, pp.149-181.

Hayles, N. K., 1999. How we became posthuman: virtual bodies in cybernetics, literature and informatics. Chicago University Press, Chicago.

Hayles, N. K., 2005. My mother was a computer: digital subjects and literary text. Chicago University Press, Chicago.

Hawkings, S., 2007. My experience with ALS [online]. Available: http://www.hawking.org.uk/disable/dindex.html/ [31 July 2007].

Kaptelinin, V., 1996. Computer-mediated activity: functional organs in social and developmental contexts. In: Nardi, B. (Ed.), Context and consciousness: Activity Theory and human-computer interaction. MIT Press, Cambridge, MA, pp. 45-68.

Kim, J. H., 2004. Cibernética, ciborgues e ciberespaço: notas sobre as origens da cibernética e sua reinvenção cultural. Horizontes Antropológicos 10, 199-219.

Kunzru, H., 2000. Genealogia do ciborgue. In: Silva, T. T. da (Ed.). Antropologia do ciborgue: as vertigens do pós-humano. Autêntica, Belo Horizonte, pp. 131-139.

Leontiev, A. N., 1981. The problem of activity in psychology. In: Wertsch, J. V. (Ed.), The concept of activity in Soviet psychology. M. E. Sharpe, Armonk, NY, pp. 37-71.

Levy, N., 2003. Cyborgs-R-Us. ACM International Conference Proceeding Series, v. 101. Selected papers from conference on Computers and Philosophy 37, 13-17.

McLuhan, M., 1964. Understanding media: the extensions of man. MIT Press, Cambridge, MA.

Silva, T. T. da, 2000. Nós, ciborgues: o corpo elétrico e a dissolução do humano. In: Silva, T. T. da (Ed.). Antropologia do ciborgue: as vertigens do pós-humano. Autêntica, Belo Horizonte, pp. 131-139.

Turkle, S., 2005. The second self: computers and the human spirit. The MIT Press, Cambridge, MA.

Vygotsky, L. S., 1981. The instrumental method in psychology. In: Wertsch, J. V. (Ed.). The concept of activity in Soviet psychology. M. E. Sharpe, Armonk, NY, pp.134-143.

Warwick, K., 2002. I, Cyborg. Century Books, London.

Wertsch, J. V., 1998. Mind as action. Oxford University Press, Oxford.

Wiener, N., 1950. The human use of human beings: cybernetics and society. Houghton Mifflin Company, Boston.

Wiener, N., 1966. God and Golem, Inc.: a comment on certain points where cybernetics impinges on religion. The MIT Press, Cambridge, MA.

Wood, D., Bruner, J., Ross, G., 1976. The role of tutoring in problem solving. Journal of child psychology and psychiatry, 17, 89-100.