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ANDROCENTRIC ARTIFACTUALITY. ANALYSIS OF THE RELATIONSHIP BETWEEN HUMAN ARTIFACTUALITY AND GENDER VALUES

ARTEFACTUALIDAD ANDROCÉNTRICA. ANÁLISIS DE LA RELACIÓN ENTRE LA ARTEFACTUALIDAD HUMANA Y LOS VALORES DE GÉNERO

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Abstract: The conceptions about technology have gone through different stages. We believed, with Rousseau, that technical progress transformed society away from virtue. We believed, with Ellul, that technology followed its own course without socio-political interference of any kind. Today some accept that technology responds to economic, social and political factors, among others. Technological facts are no longer seen as arising solely from the pure drive for efficiency; technology is on a par with cultural beliefs and values. The intention of this article is to show that in the history of technology an attitude of a cultural order is sometimes manifested: androcentrism. This attitude raises several questions about how technological development can be influenced by gender prejudice and discrimination. Thus, the concept of androcentric artifactuality is presented and the linkage of technological products with political and social biases is analyzed; biases that historically and still today affect technologies with the same familiarity.
Keywords: Technological discrimination; Androcentrism; Sexism; Gender bias; Gendered artifactuality.

Resumen: Las concepciones sobre la tecnología han pasado por diferentes etapas. Creíamos, con Rousseau, que el progreso técnico transformaba la sociedad alejándola de la virtud. Creíamos, con Ellul, que la tecnología seguía su propio curso sin interferencias sociopolíticas de ningún tipo. Hoy algunos aceptan que la

tecnología responde a factores económicos, sociales y políticos, entre otros. Ya no se considera que los hechos tecnológicos surjan únicamente del puro afán de eficiencia; la tecnología está a la par con las creencias y los valores culturales. La intención de este artículo es mostrar que, en la historia de la tecnología, ocasionalmente se manifiesta una actitud de orden cultural: el androcentrismo. Esta actitud plantea varias cuestiones sobre cómo el desarrollo tecnológico puede verse influido por los prejuicios y los sesgos de género. Así, se presenta el concepto de artefactualidad androcéntrica y se analiza la vinculación de los productos tecnológicos con los prejuicios políticos y sociales; prejuicios que históricamente y aún hoy afectan a las tecnologías con la misma familiaridad.
Palabras clave: Discriminación tecnológica; Androcentrismo; Sexismo; Sesgo de género; Artefactualidad de género.

Introduction

Since the beginning of the so-called second feminist wave, there has been a growing awareness of the urgency of a critical reflection of artifacts from a gender perspective (Bleier, 1991; Fox et al., 2006; Harding, 1999). Over time, not only has this awareness continued, but different feminist movements have emerged that explicitly address the challenges of technology, such as Donna Haraway's cyborgfeminism (1985), Judy Wajcman's technofeminism (2004) or, more recently, the xenofeminism of the Laboria Cuboniks collective (Hester, 2018). Thus, research on gender-linked human behavior (roles, stereotypes, biases) in relation to the design and use of artifacts is a burgeoning scientific area and a socially attractive topic. Even topics linking technology and gender studies have a growing interest in advertising. However, against all odds, feminist philosophy of technology does not always include epistemic issues and there is a lack of work that devotes space to the analysis of artifactuality.

Some attempts have been made from constructivism, focusing mainly on the possibilities of change in the social dimensions of technology (e.g., Bijker & Law, 1992; Berg & Lie, 1995; Wacjman,

2006). Thus, Anne-Jorunn Berg and Merete Lie asked whether artifacts have gender (Berg & Lie, 1995, p. 333). In this paper we borrow the question and the idea from the traditional concept of technology that associates industrial technology and "brown line" appliances with masculine connotations (Sørensen & Berg, 1987). There also remains the idea that women have been denied access to technologies and technical competence (Rasmussen & Håpnes, 1991), which has consequently implied a fundamentally male and male chauvinistic technical perspective regarding expectations on female users/consumers of technological artifacts. However, by focusing on everyday technological tasks, such as office work and household chores, on the analysis of the context of use and what people did, to explain women's technological experience and lives (Berg & Lie, 1995, p. 343), these studies neglected the epistemological analysis of artifactuality and plans of use to substantiate the androcentric character of artifacts.

The aim of this article is to explore the dialogue between what can be called a feminist perspective and the philosophy of artifacts. Specifically, what we ask here is whether the history of technology has specific gendered consequences and, consequently, whether certain artifacts are inherently androcentric. We base our suggestion on an indeterministic assumption of technology. Voluntarist sociology holds that technological change depends on a socially constructed tower of values based on free preferences. In contrast, technological determinism acts as an insulator between technology and all other factors by not having an explanation that brings technological change into contact with economic and political factors. However, the indeterminist position will understand that technological systems are not immune to human intervention and intentionality, just as technological development does not escape the sequence of decisions made in the past.

In this sense, we study whether the consequences of gender are embedded in the attributes of artifacts, whether the consequences derive from how the technology is used, or whether there is a combination of both. To this end, we address these questions from the functionalist perspective of artifacts and argue for the idea that androcentrism may manifest itself intrinsically in artifacts because of human intentionality, influenced in turn by sequences of prior decisions. First, in section 2, the notion of artifactuality will be mapped and some of its characteristics will be analyzed. In this way, it will be distinguished how certain objects are to be considered properly social artifacts, themselves originating with gender attributes. Later in section 3, in this line, the premise of Trevor Pinch and Wiebe Bijker (1987) that technological artifacts are the result of social processes that follow the interests of different groups, but without ignoring the weight of history, will be followed. Finally, some examples of artifacts will be analyzed, showing how they are traversed by gender biases.

This paper, therefore, attempts to go beyond constructivism and determinism; focusing on the traditional gender perspective, such as the historical feminist discourse on reproductive technologies, but capturing some of the more artifactuality-oriented philosophy that followed from the empirical analysis of sites of technological development. For this purpose, we do not start with the feminism of Haraway, Wajcman or other feminist authors, but use a perhaps unexpected epistemological starting point: human artifactuality.

Artifactuality and related dimensions

There is a widespread tendency among contemporary philosophers of technology to include the dimension of human intentionality and agency in the analysis of technological systems or artifacts.[1] These interpretations of technology differ radically from interpretations that understood technique as something impenetrable that follows its course through its own laws and its own autonomy (e.g., Ellul, 1954). The implementation of intentionality encourages us to ask ourselves about the characteristics of technology, but no longer from the fatalistic approach that views technology as something ungovernable (which, through making increasingly efficient systems, will lead us to a certain more or less desirable state of affairs), but from an approach to technology in which the intentions and interests of certain groups of agents show that technological change does not always follow purely technical criteria and, certainly, does not always point to that independent fatum that manifests itself above the human will (Winner, 1980; Quintanilla, 1989).

Artifactuality and intentionality

There are certain considerations that have spread throughout technological cultures, such as that these artifacts are generally presented as intrinsically neutral and, in turn, as creations resulting from human intelligence, from homo faber (e.g. Ellul, 1954; Kranzberg, 1980; McLuhan, 1994; Mumford, 1973). This idea is

[1] In this paper, we will only focus on human artifactuality, without analyzing how artifactuality manifests itself in other animal species. However, it is interesting to note that artifactuality does not manifest itself only in the human species. Detailed studies have been carried out in disciplines as varied as ethology or the philosophy of technology where it has been shown that intentionality, artifactuality and even culture are not exclusive to human beings. For this case, see Cuevas (2016 and 2019).

linked to the idea that tool making and tool use are exceptional qualities of human beings.

In his *Creative evolution* (1911), Henri Bergson defines homo faber to theorize human intelligence, writing that "intelligence, represented in what seems to be its original demarcation, is the faculty of making artificial objects, in particular of tools for making tools, and of varying the making indefinitely" (Bergson, 1911, p. 139). In *The Human Condition* (1958), the philosopher Hannah Arendt develops a discussion around the notion of homo faber with a simple definition very close to Bergson's: "the Latin word faber, probably related to facere ("to make something" in the sense of production), originally designated the manufacturer and the artist who works on hard material, such as stone or wood" (Arendt, 1958, p. 136). Arendt continues to see an interdependent relationship between human intelligence and technical capacity. The homo faber is contrary to the animal laborans because, instead of working with nature, he has always freely destroyed it with the help of his primordial tools, his hands (Arendt, 1958, p. 150). Moreover, the modern mastery of homo faber depends on his understanding himself as the measure of all things (*Homo omnium rerum mensura est*). Human beings are homo faber beings, that is, they manipulate tools generating a technical culture and actually constituting the contents of the human mind. Therefore, the human being as homo faber thus acquires the typical meaning of homo sapiens, since the faculty of making is not opposed to the faculty of knowing.

Centuries earlier, in the same line of connection between the human hand and the development of technology, Anaxagoras affirmed that it was the possession of hands that made man the most intelligent of the animals. Aristotle, on the other hand, was of the opinion that the human being has hands because he is the most intelligent animal: "Anaxagoras," says Aristotle, "affirms that man is the most intelligent of the animals because he has hands, but it is

logical to say that he receives hands because he is the most intelligent. The hands are, in fact, a tool, and nature always distributes, like an intelligent person, every organ to him who can use it" (*Part. an.*, IV, 8–11, 687a). So the human being would make use of his hands, the most versatile tool he possesses, to realize the ends of understanding. Despite their differences, both Anaxagoras and Aristotle relate technical ability to human intelligence, thanks to which craftsmen are able to devise and produce new objects with the help of hands and other tools, and thanks to which, in general, users have the ability to know the functions of these artificial objects and to use them.

The debate about which came "first," technique or brain, is still ongoing, and perhaps there are good reasons to claim that great brains followed technique, but certainly the relationships between technique and intelligence are undeniable. Specifically, there is a strong relationship between the creation/manipulation of artifacts and intentionality.[2] In this sense, according to an extended definition of technical system, the part of culture that allows human beings through intentionally oriented actions to produce valuable objective changes and transform concrete objects efficiently in a medium is called technical system (Quintanilla, 2005, p. 47); in this sense, an artifact is an object or system produced through an intentional system of actions, i.e., a technique.

More recent works have followed a similar definition. Yoshinobu Kitamura and Riichiro Mizoguchi (2010) consider an object to be an artifact if it has been created by a production process intentionally carried out by one or more agents with the aim of producing such an object that is expected to perform a function (Kitamura & Mizoguchi, 2010, p. 310). These authors have pointed out the importance of human agency and the intentionality of that agency in the process of constructing artifacts and, subsequently, of

[2] Intentionality is understood here as a by-product of intelligence.

performing a function. The producer of the artifact or the one who performs a function with it is a human being with agency and intentions. The concept of a function must be attributed to an agent who is considered a principal actor to perform the function. Along these lines, Stefano Borgo and Laure Vieu (2009) argue that technical artifacts are physical objects that an agent or group of agents create by selecting a material entity as a constituent of the object and attributing it to a functionality (Borgo & Vieu, 2009, p. 273). These considerations assume a "dual nature" of artifacts as physical objects created by an agent (or group of agents) for the realization of a function, from a manufacturing plan for an object with a functional physical description (Kroes & Meijers, 2006; Kroes, 2010). In other words, artifacts, thought of and produced in a design context, on the one hand, are objects with physical structures especially competent to perform a function and, on the other hand, are functional objects that have an intrinsic relationship to the mental states and intentional actions of agents.

All these definitions of artifact assume that artifactuality is manifested through intentionality. Intentionality occupies a decisive role in determining the functions of artifacts, in the sense that without the intentionality of agents it makes no sense to claim that artifacts have attributed functions. These agents even visualize an artifact and its function before they make or manipulate it, so artifactuality is not blind at all.

Intentionality and agency

To be an artifact means, among other things, to be designed, produced, used and considered as an artifact by intentional agents. As we have said above, and given that artifacts are objects whose functional characteristics are related to the mental content and intentional action of designers, producers or users who somehow

interact with physical or virtual systems, agency and intentionality seem to be distinctive elements of human artifactuality. In a line close to this, Lynne Rudder Baker (2004, 2006) has proposed an ontological theory of artifacts based on the relations of the constituent parts of artifacts. Her basic idea of constitution is that when certain things of certain kinds occur in certain circumstances (different circumstances for different kinds of things), then new entities of different kinds become manifest (Baker, 2004, p. 101). Thus, for example, an anthem, but not a mere set of sounds can make a person's nationalistic spirit manifest. The case of the anthem serves as an example to think about artifacts having proper functions and being used or designed and produced to perform these functions. This is regardless of whether at a later time the artifacts perform in the context of use the functions for which they were designed. Thus, artifacts have an additional characteristic in addition to the structural characteristics: their (proper) function embedded in a plan of use.

However, not every type of action is an intentional action, and not every type of natural or artificial being possesses the capacity to perform intentional actions, and therefore does not possess artifactual capacity. Intentional actions are characteristic of higher organisms endowed with the capacity to know, conceive and value purposes. Following the premise of Riso Hilpinen, who considers that an object is an artifact if and only if it has an author with intentions and concepts (Hilpinen, 1993, p. 157), Amie Thomasson has offered a cogent proposal of intentionality in the production of artifacts. She proposes that for any essentially K-type artifact, something is a K only if it is the product of a largely successful intention to make something of type K, where such intentions must involve a substantive conception of what kinds of features for K are relevant (Thomasson, 2009, p. 206). Artifacts, then, would be the result of human intentions to produce something of a specific type. And, in the same line, Baker suggests, and confirms what we are

trying to emphasize here, that the uniqueness of (human) artifacts depends on the intentionality of those who produce it with a specific function (Baker, 2006, p. 132). The identity of artifacts, in this sense, is defined, constituted and recognizable by the functions for which the object was produced.

In line with this intentionalist approach to technical products, Quintanilla et al. (2010) outline the general character of an intentional theory of action. They consider three fundamental characteristics of intentional action: the desire to achieve a goal; the thought that, if a certain action is performed, that goal will be achieved; and the actual performance of the intended action. Consider, for example, the approach of an agent, of an engineer *x* vis-à-vis a previously valued goal *z*. An intentional consideration of *x* act seems to have, at least, these three main criteria:

i. Desire criterion: *x* wants to achieve goal *z*. It must have a desire, and since *x* wants to achieve goal *z*, we assume that it wants to have access to the attainment of *z*. The content of the desire can be represented as access (goal *z*).

ii. Belief criterion: *x* thinks that if he performs a certain action on *y* he will achieve *z* (or with a certain degree of certainty he will achieve *z*). He must believe that a certain action on y causes access to target *z*.

iii. Realization criterion: *x* actually performs the action he has thought about. Through a process of practical inference, *x*'s mental state of desire and mental state of belief interact to produce a third mental state, an intention to perform an action that will give him access to target *z*.

According to this definition, intentional actions can encompass physical, psychological and social types of intentional actions. As for the intentionality present in artifactuality, the creation of a particular artifact is the result of the realization of the agent's intention, the content of which implies an idea of the kind of thing

being created. One can clarify this idea as follows. Given an agent A and an artifact R, A creates R only if the following conditions are met:

i. A has the intention H to create R. Therefore, A desires to create R. The content of A's desire to create R implies an idea of what R is and of its properties.

ii. A is able to evaluate the degree of success of his intention H to create R.

iii. A carries out the intention H. A performs the action that gives him access to the creation of R.

The intention, whose content involves a certain desire about a certain artifact concept, will determine the artifact that will be realized, insofar as the successful realization leads to a material structure that satisfies the intended properties of the artifact.

Human psychology has traditionally studied intentionality as a fact about the mind that develops throughout the early life of human beings, being able to distinguish directed human actions (Sommerville & Woodward, 2005; Wellman & Phillips, 2001) and to detect intentions and actions (Baldwin et al., 2001). Indeed, people attribute intentions to each other in contexts as disparate as that of a trial, that of a scientific evaluation, or that of a sporting activity. This social approach to intentionality makes it possible to explain the behavior of different social groups in relation to each other and, in our case, to different artifacts.

We can implement a set of social norms and make them part of our habit because we all (or a specific group of people) intend such action, and if we implement a set of norms and make them part of our habit, then the explanation of this implementation includes the fact that we all had an intention to implement norms and make them habit (Bagozzi & Dholakia, 2002; Bagozzi & Lee, 2002). For example, when a certain group of people set out to play any board game, and find themselves in a certain environment facing the game

elements and other players, they interact or combine by intentionally assuming the rules of the game, and a kind of intentional cooperative commitment oriented toward a shared goal emerges.

Unlike personal intentions that capture individual commitment, social intentions involve a group perspective that expresses a social commitment to participate in an action. It is arguable whether each person involved in cooperative action has an individual intention derived only as part of intentionality in its social sense or whether, instead, social intentional action is derived from individual intentionality. But there is no doubt that the presence of intentionality is relevant for understanding social interactions, legal procedures or rules of the game. This issue will be further explored in section 3.

Realizability and multiplicity

Before delving into the intentionality of the notion of androcentric artifactuality and moving on to analyze the presence that the intentionality of certain social groups has in the sexist dimension of artifactuality, we pose a joint problem to the study of intentionality: multiple realizability.

The result of most practical objectives leads to what has been called “multiple realizability” (Lawler & Vega, 2011), that is, to the fact that the same function can be performed by different artifacts. In turn, one can also speak of "multiple realizability" or “multiple use” in the sense that the same material structure can perform multiple functions. This phenomenon can be considered as the result of the intentionality of the agents in the constitution of certain artifacts, and in the plan of use of these, allowing the realization of the same type of function in different artifacts and/or a variety of functions in the same artifact.

Although it is debatable how an artifact acquires functional attributes that comprise it, it is indisputable that the agents, both in the design context and in the context of use, play a very active role in this process. In technical culture, the very transmission of the technical functions in which a practical problem can be solved includes the ability to understand this functional activity: each agent learns the function (or functions) of objects by imitation and teaching; as well as by inference from the behavior of the internal systems that structure the constitution of artifacts, agents can attribute new functions as a fundamental source of functional variability in objects. This characteristic connects directly with the characteristic of intentional production and use of artifacts.

In general, intentionality-based notions of artifact are susceptible to multiple realizability, in the two senses we note here. It may be tempting to think that multiple realizability could play an important role in the powerful set of modern artifacts. In contrast, without belittling its importance in a wide variety of artifacts, it does not manifest itself to the same degree in technical artifacts as it does in technological artifacts (Lawler & Vega, 2011). Let us imagine a computational pipeline for medical research. It seems that not just any material structure meets the necessary characteristics to be the basis for software as a microchip can be for the pipeline. Or, in other words, you cannot build a microchip with, for example, flour. A set of starch macromolecules does not seem to be a suitable material structure for the construction of microchips. Therefore, multiple realizability is provided as an input to specific intentions, which in turn are manifested through the structural and functional possibility of an artifact.

This structural-functional possibility points to a desired plan of use, which in turn is the result of collective efforts, divided into a number of distinct design and production phases. As Wybo Houkes and Pieter E. Vermaas (2014) have pointed out, the use of an object

can be defined as the realization of a use plan for that object (Houkes & Vermaas, 2014, p. 172). The use plan for an artifact is a series of intentional and goal-directed actions in which interactions with the artifact are included as contributions to the realization of the plan's goal. As a relevant feature of the development of usage plans, these authors add that this development is not exclusively subject to an engineering design context. Instead, in a usage context, users can design new usage plans for the realization of new objectives involving already available artifacts.

As we see, artifact usage plans change, do not remain unchanged for long periods of time, and therefore cannot be uniquely analyzed in defined characteristics. These changes are subject to intentional action, both in a design context and in a use context. Neither an engineer's intended design nor the values that have been taken into account in the construction of an artifact definitively determine its use and social characteristics, nor their impact in a broader context of use. So the fundamental determinations of use plans and artifact functions can be comprised at least in the following:

i. Designers' intentions (in the initial design context). The technical functions of an artifact are the capabilities or objectives for which agents designed a plan of use and built or modified a competent artifact.

ii. The intentions of the users/designers (in the context of use). The technical functions of an artifact are the capabilities or objectives for which agents use the artifact or design new usage plans for existing artifacts.

iii. The technical functions of an artifact contribute causally to the capabilities of larger and more complex systems, responding to a use plan.

The technical functions of an artifact are the capabilities by which they causally contribute to the capabilities of larger, more complex systems, responding to a plan of use.Therefore, the historical and

social factor of the interpretation of functionality is admitted, which is also inevitably linked to the phase of the intentionality of the designer and that of the user, to the description of the facts and of the internal coherence of the artifactual systems. It might seem that there are two categories of interwoven judgments, those that refer to epistemic phenomena or beliefs and those that refer to objective phenomena or real entities. But this distinction does not hold for all facts. When we speak of the artifact as an objective fact or as a real condition it is such to a certain extent; there also figure in artifacts certain factors that have more to do with a knowledge about the social-historical functions that the objects cover than with what the objects are really like. What an individual may perceive as ease of use or usefulness may depend not only on the intrinsic characteristics of the technological system, but also on the history of the objects and the changing contexts in which the technological system is evaluated, i.e., technological success, development or innovation are understood as sub-processes of society (Agarwal & Karahanna, 2000; Compeau et al., 1999; Strauss, 1978).

A technological frame can be defined as that subset of organizational frames of group members that refer to the assumptions, expectations, and knowledge they use to understand technology in organizations. This includes both the nature and historical role of the technology itself, as well as the specific conditions, applications and consequences of that technology in particular political contexts (Orlikowski & Gash, 1994, p. 178). Thus, many technological products, such as buses, bridges, plumbing, etc., have some relationship to general neglect and politics or to the social desires of certain political groups. Proof of this is that a large number of artifacts are being modified or replaced by new designs due to new political ideations, new values, demands and social needs (green spaces, artificial beaches, sidewalks adapted to people in wheelchairs).

The importance of "non-technical" or "extra-technical" values is recognizable because, where a technology succeeds because its social context allows it to do so, certain cultural, social, religious, economic, etc. characteristics can cause it to fail. Success does not depend solely on efficiency or on whether an artifact is technically better; this is shown, for example, by the case of VHS versus the Betamax system, where the latter lost, or the success of the QWERTY keyboard (David, 1985; David, 1986). That is, being included in a society and in constant relation with cultural contexts, the change of technology depends on a set of factors also in continuous change (political, economic, ecological, ergonomic, etc.) (Niiniluoto, 1997; Echeverría, 2001) and on past situations. Technological change is, on the one hand, the result of a multitude of factors that intervene in it, each in a variable way and to a variable degree; on the other hand, it is the result of a history that is not exogenous to decision-making. As we shall see with some examples, history runs through all these factors, i.e., decisions, routines or actions taken today are influenced by decisions, routines or actions that were taken in the past. Decision-making does not depend only on the current context, but also on previous decisions that generate persistent effects, even in the face of changes in the context.

After viewing technical objects in this light, it would not be fanciful to imagine that, in this world of actions, there is an artifactual system upon which historical and social attributes rest. By virtue of intentional action, it seems that many types of artifact cannot have a magnitude isolated from the practical, political and ethical life and history of societies. Moreover, as the execution of a plan of making and use by agents who are members of a community, to come to understand not only the existence but the incidence of certain artifacts in societies-and how social values impinge on contexts of design and use-requires at least a projection of the artifact or its constituent materials imbedded in a particular cultural context:

something cannot lose membership in a certain kind of product culture without an unjust modification of its history.

In what follows, the background of human agency is sketched out in which the development of some technological artifacts is embedded and contextualize human intentionality in the discourse of gendered meanings and relations. To this end, I invoke the meaning that has been attributed to gender in the technological relations between men and women in which artifacts have been adjusted to men's will-making. Thus, artifactuality for this study means intentional sequences through which gendered meanings and forms are assigned to artifacts, at levels of design. In recognition of these intentional actions, it is argued that the design and subsequent use of certain artifacts are implemented by the hegemonic androcentric androcentric structures under which these technologies are produced.

Gender meanings in human artifactuality

There has been much discussion about technology being the prime mover whose automatic and unidirectional march determines history, and some authors have disputed the radical proposition of technological autonomy and suggest another canon. For example, in Feminist Technology (2010), Linda L. Layne considers technological artifacts not in isolation, but together with specific knowledge that integrates social, political and technological contexts, i.e., they are the result of human intentions embedded in a society (Layne, 2010, p. 3). As a social by-product, technology would have inevitable social-historical forms, one of which is manifested through gender relations. In other words, many technologies cannot be fully understood without reference to gender conditions. They are not mere artifacts to be judged for their own

sake, but must be interpreted in terms of their effects on women's lives and their position in history and society.

By analyzing technology from a gender perspective, a new attitude of vigilance and care is offered that allows us to elaborate new discourses and interpretations for some of the most problematic and confusing formulations that have occurred within the development of human material culture. This perspective points out that certain artifacts are the product of intentions oriented by gendered meanings, thus eliminating the myth of properly impartial and objective technology. Judy Wajcman (2004) expressly points this out: the very definition of technology is forged in the key of masculine activities (Wajcman, 2004, p. 28). We tend to think of technology in terms of industrial machinery, automobiles and ICTs, ignoring other technologies that affect most aspects of women's daily lives. It has even been found that, artifacts having been adapted to women's needs, often could not be considered feminist technologies because of their sexist motivation (Loh, 2019). It is not to be understood that we can analyze these differences here, but they deserve at least this brief attention.

In this epigraph, it will be shown that technological products, besides being the result of human creativity, in a significant variety also respond to social demands and values. Among these values we find gender biases. This is because technological development is mainly embedded in social, political and economic systems that are patriarchally hierarchical (Firestone, 2003; Gearhart, 1979; Lykke and Braidotti, 1996; Mies, 1986; Ortner, 1972). Now, not every artifact that may appear at first glance to be a non-androcentric or non-gender-biased technology deserves to be identified as such. Nor are artifacts that are androcentric simply because they have some attributes recognizable at first glance as androcentric. Apart from the more obvious attributes of the technology and the technological artifact itself, identifying them as androcentric often depends, on the

one hand, on the more subtle attributes that appear embedded in a larger technological culture and, on the other hand, on the feminist perspective with which it is analyzed (Loh, 2019, p. 2). To avoid this difficulty as much as possible, our starting point will be to point out the sociocultural dimension of technology planning and then to analyze the usage plan from a gender perspective.

Gender meaning in the "use plan" of the artifact

Building on the idea from section 2 that the technical functions of an artifact respond to an intentional use plan, and can be understood as the capabilities through which it causally contributes to the capabilities of larger, more complex systems, the focal point of this artifact use plan work is the discursive exclusion of women from technology and, therefore, the genderization of technology, that is, the accommodation of gender as a social class to the design and production of different technological artifacts. Consequently, the presence of two biases that permeate the whole process of technology design unfolds: the tendency to ignore the differences between the sexes and the tendency to exaggerate them (Hare-Mustin & Marecek, 1994). This distinction of differences is present both in social hierarchization and in the relationship of this hierarchization and technological development in the form of material results that, at times, although they could be assumed for men and women alike, are assumed to be exclusively women's (see, for example, the development of the contraceptive pill). Thus, there are consequences for the quality of technological applications, i.e., a "bad technology" on the other half of the human experience (Hyde, 1995).

However, given the variety of the content of the technological dimension, it is likely that we are unable to sort out all the forms of gender attached to artifacts. We are all susceptible to implicit and

unconscious biases, which is especially true in terms of gender (Eagly & Mladinic 1989; Eccles et al. 1990), with gender being an explicit or implicit element in developing technology (van Oost, 2003). Now, although gender representation is often difficult to grasp, it is common to think that it is not yet a matter of course that both men and women are included in the technological society in the same way and in the same way wisely benefit from it (Sørensen, 2013). This issue of gendered meanings in artifacts can be seen fundamentally in the analysis of two major contexts (that of design and that of use) that coincide with the point of reference from which we start and the importance we attach to each issue.

From this analytical framework, an interpretation of the relationship between technology and society can show that, in a context of use, where a biased or discriminatory use plan is carried out that has nothing to do with the structure with which this artifact was designed, the blame for the artifact having a biased or discriminatory dimension will be on the user. David Sarnoff is a proponent of this view. In an interview, Sarnoff stated that the products of modern technology are neither good nor bad in themselves; it is how they are used that determines their value (McLuhan, 1994). In other words, if an artifact is improperly used in a sexist manner in a broad sense, it is the fault of those who use it in this way. If someone forbids the use of a car to female members of a family because they are women, this person has no one to blame but himself for such sexist behavior in the context of car use.[3]

[3] It is not ignored that the sexist tendency is of a cultural nature. The example is an attempt to distinguish between the general technological sexism that manifests itself in the use of artifacts and the intrinsic sexism in the design of technological products. Nor is it ignored that the technological activity of men has silenced that of women, which in turn has served to direct most technological research as it has suited men, neglecting both the female history of technical inventions and certain technological needs of women.

In contrast, a more complex interpretation would be to understand the content and design of technological artifacts in terms of social-historical constructs in the sense that, even in the design context, artifacts are emergent systems of technological culture itself; they are objects that simultaneously embody and measure a set of relations between heterogeneous cultural elements. As Madeline Akrich has pointed out, there is a link between society and technology whereby artifacts – "technical apparatuses," she says- are objects that define agents, technical objects and the relationships between them: In other words, in a technological society it is essential not to radically assume a distinction between the technical and the social, because these relations between agents and artifacts evidence those forms of linkage that are necessarily and simultaneously technical and social (Akrich, 1992). Thanks to these linkages, elementary mechanisms of adjustment between the artifact and its environment can be extracted, as, for example, the way in which agents relate to an artifact in the context of use is highly conditioned by the agents of use assumed in the design of the plan of use and the decisions made by the designers.

Technological products would be composite, culturally heterogeneous and physically localized structures, forming part of a chain of intentional functions and designs, i.e., products of heterogeneous networks that bring together actors of different types within a variety of technological cultures articulated in the larger society. Akrich has argued that when the characteristics of artifacts are defined in the design context, designers necessarily make assumptions about the beings, tendencies and tastes of the agents, roles and other socially specific forms that make up the world in which the artifact will be inserted and articulated (Akrich, 1992, p. 208). In a word, technological systems include agents who have beliefs and values; a technological culture that affects the use, design and diffusion of certain technological use plans.

In order to go deeper into the presence of sociocultural values in the context of artifact design, it is useful to resort to the reconstruction proposed by Houkes and Vermaas on which productive activities are involved in the production of artifacts. Product design, manufacturing design and fabrication are the three activities that focus on artifact production (Houkes & Vermaas, 2014, p. 171). From these activities, the content and the way of realizing the objectives can be characterized by means of use plans. Thus, for example, individual transportation technology using automobiles includes a car culture with several variables, i.e., the car leaving the factory incorporates cultural elements in its design. Thus, a plan of use for a given automobile and a given context is a series of considered and goal-directed actions in which (limited) interactions with the artifact and other cultural elements are included as contributions to the realization of the plan's goal.

These are thus goal-directed actions that can affect the adoption, development and success in the application, use and utilization of a certain artifact. Since cultural factors are a subclass of the heterogeneous elements with which the ordered series of actions for a usage plan interacts, it is possible to combine the theory of usage plans with the case of technological culture. What Houkes and Vermaas call a usage plan, a program that includes the consideration of specific actions in relation to various elements, descriptive contents and objectives, can be understood as a content part of what Quintanilla has called the culture embedded in the technical system. The technological culture embedded in a technical system is formed by the set of beliefs or knowledge, habits and values that the users or operators of a technical system need to have for it to function properly (Quintanilla, 2005, p. 277).

Thus, we can talk about the aspect of the main components of this cultural content, which would be constituted, on the one hand, by the knowledge or representations (beliefs, theories, models) of the

artifact and its context, skills and rules of operation; and on the other hand, it would be constituted by the behavior patterns, preferences or valuations regarding the objectives and results of the system (Quintanilla, 2012, p. 116). Therefore, through the use plan certain agents can realize an objective and, in executing this plan, these agents must interact with various cultural elements due to the specific contribution capabilities of these elements. In this network of relationships, technology developers would assume a decisive role, since it is in the design context where potential users are defined and from where ideas related to the content of technologies are incorporated into the target audience.

Thus, it is in the context of use where the contact between the designer's intentions and the user's intentions is incorporated (Broncano, 2008), resulting in artifacts where the technical and cultural dimensions converge. Akrich has called this incorporation "script" (Akrich, 1992, p. 206). With this notion it becomes visible how users' representations, which are previously inscribed by designers in the technical content of artifacts, influence technological development, and how the artifact subsequently shapes the users' environment (Akrich, 1992, p. 208). Consequently, technical products have a script or a plan for use that prescribes what users have to do to realize the intended functioning of the plan.

Akrich's script approach has been extended to include gender analysis. Thus, researchers such as Ellen van Oost (2003) have developed the notion of "gender scripting" that reflects on the explicit or implicit incidence of gender meanings in technological production:

> certain technical artifacts are produced explicitly for women or men in the context of certain gender-specific stereotypes, while other artifacts only implicitly reflect gender in the production process, for example, by male designers who use themselves and their experiences as

> reference categories in the development process (van Oost, 2003, p. 195).

These scripts, whose technological strength depends largely on the team of designers who approach the development process, refer to the representations that the designers of an artifact have of gender relations that they then inscribe in the structure of that artifact. Thus, gender scripts consist of gender characteristics and images that are incorporated into the design of artifacts. As a consequence, these gender scripts – cultural representations and elements, in short – embedded in the contents of the use plans attribute and delegate specific competencies, actions and responsibilities to the intended users.

We can most clearly observe these normative meanings related to material artifacts and to the inclusion of gender aspects in the case of personal car safety systems. Despite the fact that female consumers are increasingly buying cars for personal use, including larger and larger vehicles (SUVs, pickups and minivans (Ulfarsson & Mannering, 2004)) and the demand in recent decades for more and better car safety by women, car companies are just beginning to develop safety systems for women.

This fact responds to the capabilities by which the functions of an artifact causally contribute to the capabilities of larger and more complex systems and to what in economics has been called path dependence, i.e., many crucial social phenomena can be adequately explained in historical-economic terms. There would thus exist a causal dependence of subsequent events in relation to previous events: what has happened at an earlier time will affect the possible outcomes of a sequence of events occurring at a later time (Sewell, 1990, p. 16). In the framework of this conceptualization of dependence, the cumulative consequences of past actions increasingly constrain and limit future actions (Griffin, 2007, p. 4). From the point of view of androcentric artifactuality analysis, this

notion of path dependence can be used to examine the determinants of key actions at any given historical moment, explore counterfactual actions and help explain why certain technological choices are not being made.

Jim Mateja (1995) pointed out that the difference in injuries to the bodies of women and men in traffic accidents may be associated not only with the vehicle being driven, but also with the attributes of the drivers themselves.[4] This emphasizes the need to take into account the multiple variables of driver characteristics and vehicle design, in addition to taking into account, for example, environmental conditions or type of roadway. Among these variables, there are two fundamental ones that can be taken into account in the analysis of injuries caused by motor vehicle accidents. On the one hand, the gender of the driver and the consequences that average physiological differences may have on the severity of crash injuries; on the other hand, related to the previous variable, the interaction of the driver with the safety design of the vehicle (location and functioning of the airbag, crash zones, seat belt design).

Now, are the differences in injury risks related to the way in which the safety systems installed in vehicles function for male and female occupants? It is thought that one of the reasons for this difference is that, typically, major automakers' usage plans are still designed to develop universal safety systems adapted to the size of males. Most manufacturers still test the safety of their models with male anatomy dummies (Sedeño & Dauder, 2017). Therefore, there

[4] Numerous studies have explored the differences between men and women in accident severity (Abdel-Aty & Abdelwahab, 2001; Evans, 1988; Laberge-Nadeau et al., 1992; Mannering, 1993; Massie et al., 1995). These studies have shown that the frequency of motor vehicle driving injury is higher in women than in men. In addition, women are more likely to die than men in serious accidents of the same type (Evans, 1988). In general, women are more fragile than men, which means that they are more susceptible to injury under comparable loading conditions and are more likely to die from comparable injuries.

is still a need to develop and implement testing methods that assess by gender the risks of injury. Furthermore, these methods should take into account the fact that most concussions occur to female occupants and, therefore, prioritize injury prediction in women.

As can be seen, technological culture responds to heterogeneous networks of factors. However, to speak of heterogeneous networks where heterogeneous elements are brought together that go beyond intentional actors, that are interwoven between factors of different types and sizes, such as history or the market, is neither a purely constructivist nor a purely deterministic approach (Akrich, 1992, p. 206), since we are constantly moving between the technical, the social and the historical. A gender study of the telephone, for example, found that telephone use became a way for women to express femininity (Rakow, 1992). But the appropriation of the telephone by female users not only helped the emergence of new forms of female interaction, but also made it possible for the telephone to be reshaped (Martin, 1991). As a device originally designed as a business communication tool, the telephone was gradually modified to become a practical social communication device for use in the domestic sphere.

The main idea that can be drawn from this analysis is that the domestication of technological artifacts is a process of mutual adaptation in which both gender and technology are constantly being reshaped through relationships of use and design. This conceptualization of technological systems and products combines two fundamental ways of viewing our technical world. One, we can conceive of the world of technical products as spaces of artificial material organization that possess an identity independent of human intentionality; and, two, as being formed by agents, mainly human beings, who intentionally represent the world and act in it on the basis of reasons (Kroes & Meijers, 2006). This means that technological products and their changes, as in the case of the home

telephone, can only be adequately described in a way that combines material and intentional structural conceptualizations of the world.

In this way, an alternative channel is enabled to begin to focus on two characters of gender traits in technology. The first concerns how the structure of an artifact constrains users by gender as they relate to the artifact; and the second concerns how female and male users relate to each other in concomitance with the artifact. Therefore, it is not possible to understand the place of artifacts independently of social notions of gender, i.e., through these notions, one can come to reconstruct the decision-making and power relations that condition both the constitution of the artifact and the agency of the target users. Along these lines, Waltraud Ernst (2013) suggests that to understand artifacts we need to include the relationship between the research and development of technological artifacts and the specific needs and desires of entire social groups. Therefore, technological development is understood as a cultural product that is produced in sociocultural processes by people in their respective sociocultural positions.

The projection of the plan of use of artifacts in the design context depends on – or takes into account – the intended users. This makes the characteristics of artifacts the consequences of actions and intentions imbued with sociocultural representations. Therefore, the designs of these artifacts will have sociocultural attributes. The sociocultural features of artifact development, in terms of gender, become evident when artifacts defined by gender systems are developed. These gendered features can be located by studying the special needs and desires for specific technological developments, thus artifacts being the result of a dynamic process of repeated materialization of gender norms and meanings that responds to the sociocultural context.

However, this constitution of humans and artifacts does not occur in a single time and place, nor does it create fixed relationships or

entities between humans and artifacts (Suchman, 2007, p. 268). When an artifact is used for the function it was designed for, in situations that are consistent with the plan of use for which the artifact was designed, the discriminatory dimension is variable. Gendered subjects and objects can experience new interpretations, because they are changeable (Ernst, 2013, p. 116). The gendered meaning given to a technical artifact is often diverse and changeable and depends on the specific context of use. Consequently, the human-artifact constitution and interaction can change themselves, each other and the cultural environment and change especially the gendered meaning.

When developing, manufacturing and putting into circulation an artifact such as, for example, an automobile, those in charge of designing the use plan and constructing the artifact are committed to the predictions made about the behavior of the artifact and the sociocultural representation they have of the target users. If the use plan and the constitution of the car are designed on the idea that it will be males who will use the cars exclusively or to a greater extent, the characteristics will respond to this belief and the car components will be manufactured to solve certain practical situations linked to males. The general consequences will be that the needs of the female population will be ignored in automotive matters and discriminatory automobiles will be designed, thus turning the automobile into a new form of expressing masculinity (van Oost, 2003).

This explanation is based on an integral understanding of technology that includes standardized and well-rehearsed artifacts, practices, methods, and processes (Grunwald, 2013; Hubig, 1995, 2013; Kranz et al. 2007). We draw attention to these kinds of often inadvertent gendered meanings and symbols that occur in the context of design and manufacture, in order to understand in what ways the production of some artifacts has been directed through an androcentric fixation by gender, as well as an anthropocentric

fixation by a human – especially a male – subject of knowledge. Naturally, the context of use is an important place where artifacts appropriated in everyday life can function as symbols expressing gendered meaning. The use of artifacts in one's daily life is an important phenomenon in which individuals construct their gender identity. However, it is not the only place where artifacts acquire gendered meanings. Just as a Siemens brand manager pointed out that they do not sell appliances, but a lifestyle (Verbeek, 2000, p. 12), designers make plans for the use of artifacts immersed in socio-cultural values and, in addition, take into account the values and symbols they consider appropriate for the target consumer group (Cowan, 1987).

Of course, technology has been primarily a male activity in the Western tradition. However, this is not the only possible premise and does not necessarily support the argument, let alone account for the problems surrounding the androcentrism that technology brings with it. In our days the problem has been complicated by new technologies, which are even more obiquitous, impenetrable and subtle than traditional industrial technologies (Quintanilla, 2017). Thus, on the one hand, many artifacts are designed for "everyone", that is, they are apparently designed without a specific target user group, but often unconsciously designers base their design choices on a generic male user image (Rommes, et al., 2002). Gender can be an implicit element in the design of technological artifacts, i.e., gendered scripts and androcentric usage plans can result from implicit processes. And, on the other hand, certain technologies have been incorporated into our daily lives with two consequences that deserve to be highlighted. On the one hand, they have been articulated in the everydayness of human life as if they were part of ourselves and, on the other hand, as if we had given up understanding them. Both consequences make it more difficult to identify the social and historical features of a technology.

What may appear as an "objective" scientific fact in reality inevitably responds to a culture in the sense that it is the result, in part, of socio-cultural processes. Technological culture is, on the one hand, a social factor of the first degree because it is socially organized; and on the other hand, a fundamental political factor because to such social organization are attached interests of domination and power. Based on the assumption that the agents of technological development and the production of its products need certain information that is part of their own culture (among other things, knowledge, beliefs or representations they possess about the components, structure and functioning of the system (Quintanilla, 2012, p. 114)), we consider that certain technological artifacts are impregnated with gender biases, which can be an alienating character especially for women. An attempt will be made to situate technology in its rightful place starting with the question What gender interactions in an interwoven technological world are being considered or provoked?

In the face of considerations of the male tradition of technological artifacts, a variety of alternative views of networking as relations of technology production and use, inspired by feminist analyses, can be articulated. The connection this paper makes between the overall technological system and gender biases, considering women's specific places in artifact development and production, is one of many that could be made. However, with Suchman (1993), these reconceptualizations of technology are particularly relevant, insofar as technologies comprise the objectification of research practice and knowledge in new material forms (Suchman 1993, p. 22). In our terms, the new forms in which the research practice, knowledge and adjacent to the general culture of technologies are concretized are new artifactual forms (in all their possible modes).

Reconceptualizing technology in the terms we present, in addition to making opaque what was previously invisible (biases,

discriminations, mistreatments), represents a change insofar as the prevailing order of technology production is put under discussion and makes possible the search for a production of technology based on the recognition and cultivation of the networks of relationships between technological development, artifacts as ultimate concretions of technology and women. Thus, the case of technological development detached from these networks has been shown, because as Donna Haraway states "we need the power of modern critical theories of how meanings and bodies get made, not in order to deny meanings and bodies, but in order to build meanings and bodies that have a chance for the life" (Haraway, 1988, p. 580).

Some conclusions

At this point, it is possible to retrace the steps taken and the initial question: Do certain technological artifacts possess androcentric attributes? It should come as no surprise that the temptation, after all, is to answer yes. A significant variety of artifacts are built on biased social images in the sense that they are designed and used on gendered meanings. This situation seems serious enough if we consider that it occurs in a current society where women have gained a lot of weight in the labor market and in society. Therefore, we can point out that the study of technology and artifacts is relevant to gender studies. Because insofar as they relate to social constructions, technological development and artifacts contain information on sociocultural models and on the possibilities for change in these models.

Thus, in order to assess whether a technology is sexist, a series of prior assessments are needed, based fundamentally on a

sociocultural diagnosis. The diagnosis made in this article has helped to understand how a group of engineers performing a behavior in the design context acts in an androcentric way. The condition that it is intentional, on the one hand, excludes from the repertoire of gendered behaviors any construction action not related to artifactuality. And, on the other hand, it helps to project examples of how sexist artifactuality manifests itself in the world.

The gender bias and androcentrism of technology and human artifactuality, however, does not end there. In studying what is generally defined as technology, one will find men as the fundamental dedication group of technology, men as designers of technology, men as engineers and technologists. Historically, technology seems to be a man's thing, and as long as technology is not challenged, this male dominance seems to confirm the view that women have little to do with technology. But this does not mean that women have nothing to do with technology. And, after all, we are now aware of the gender issues that technology brings with it and questions can be raised about the historical, social and political meaning of technological activity, about integration into the whole of human life, about the value of technological applications, about the type of society to which they point and the type of society that flows from technological development.

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