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Technology and its relation to design, as students understand them when choosing Graphic Design as a career at Universidad Nacional de San Juan, Argentina (National University of San Juan, Argentina)

La tecnología y su relación con el diseño desde la mirada de estudiantes que eligen la carrera de Diseño Gráfico en la Universidad Nacional de San Juan, Argentina

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ABSTRACT

This work presents the results of a research conducted during the 2016-2017 academic period at the School of Architecture, Urban Planning and Design, National University of San Juan Argentina (Facultad de Arquitectura, Urbanismo y Diseño de la Universidad Nacional de San Juan, Argentina). Its aim was to know and understand the main conceptions that aspirants to admission to this School have about technology and its relation with graphic design. The research has also focused on the evaluation of the coherence among the conceptions above mentioned and the theoretical framework that supports the academic proposal of the school, while mantaining a critical focus on technology. A population of the 336 students, who attended the common entry course to start a career in the School of Architecture, Urban Planning and Design in 2017, constitutes the subject matter of this research. Two purposive non-probability samples were studied, formed by students who attended the entry course and who asserted, at the beginning and at the end of the course, that they were convinced of choosing the career of Graphic Design and during the first course. The Social Representation theory and its structural approach were applied to identify the students' conceptions. Results revealed that conceptions of the students about technology were at the same time, ingenuous and reductionist, and that they consider that very little relation between graphic design and technology exists.

Keywords
Social representations; graphic design; technology; college students

RESUMEN

Este trabajo expone los resultados de una investigación llevada a cabo en la Facultad de Arquitectura, Urbanismo y Diseño de la Universidad Nacional de San Juan (FAUD-UNSJ) durante el período 2016-2017. Su objetivo fue develar y comprender las concepciones acerca de la tecnología y su relación con el diseño gráfico de aspirantes al ingreso e ingresantes a la carrera de Diseño Gráfico de la FAUD-UNSJ en 2017. El propósito fue valorar la coherencia de estas concepciones con los marcos teóricos donde se sustenta la propuesta académica de la institución y con un enfoque crítico frente a la tecnología. Para indagar en las concepciones de los estudiantes se recurrió a la Teoría de las Representaciones Sociales (Moscovici, 1979) y, en particular, al enfoque estructural de J. C. Abric (1994a). La aproximación metodológica conjugó métodos de los enfoques cualitativo y cuantitativo, mientras que el diseño de la investigación fue de tipo descriptivo y de carácter no experimental. Para la recolección de los datos se emplearon dibujos y técnicas interrogativas y asociativas. La población fueron los 336 aspirantes al ingreso y los ingresantes a la FAUD UNSJ en 2017, y sobre esta se definieron dos muestras intencionadas con aquellos estudiantes que planeaban elegir la carrera de Diseño Gráfico. Los resultados develaron concepciones ingenuas y reduccionistas acerca de la tecnología, así como una escasa conciencia del carácter tecnológico del diseño gráfico.

Palabras clave
Representaciones sociales; diseño gráfico; tecnología; alumnos universitarios

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Introduction

The B. A. in Graphic Design was created at the School of Architecture, Urbanism and Design (FAUD, [Spanish acronym]), of the National University of San Juan (UNSJ, [Spanish acronym]), in 1999. In 2015, the original curriculum was replaced resulting in a rewarding participative process in which many professors of this field of studies intervened. This new curriculum (2015) defines design as:

> A technological activity characterized by its project methodology and related to the ways in which people, intentionally and organizationally, modify the natural and social environment to improve their quality of life, acting over materials, the energy or the information, in cultural, historical and specific geographic contexts (Higher Council of the UNSJ, 2015, p.4)

This declaration is a clear posture against graphic design as a branch of design, as it distances it from others that conceive it as an activity rather linked with art and distant form the techno-scientific universe; that is, a coherent view with a conception of design where the aesthetic and the rational are not subordinated to one another but constitute a clearly linked whole.

In other words, a vision in which the primacy of the aesthetic-symbolic (close to the conception of Bauhaus design) is substituted by another one that incorporates rationality and sustenance in scientific-technological processes at the same level (closer to the Ulm School proposal) (Aicher, 1994). In short, this vision of design considers different factors in the designed product, aesthetics being one of them.

For Chaves (2004), the perspectives on design where the artistic or the rational prevails, do not imply two design internal currents, contrary and irreducible, but rather refer to two different levels from which it can be understood. In this sense, thinking of design as a technological discipline does not exclude the artistic dimension, i.e., it does not reduce it to a sole dimension. While the opposite (understanding it as a form of art) hinders the visibility of its technological dimension.

Furthermore, the approach to the 2015 Plan of the FAUD is consistent with the understanding that the field of technology "[…] does not only include the field of objects but also the field of human action generator and receptor of these objects" (Ledesma, 1997, p. 35). By being one of the particular forms of the project action, design deals with "[…] the synthetic production of material, concrete and existential objects or services related with the cultural ways of inhabiting" (Ledesma, 1997, p. 38). Hence, design is considered part of the technological universe and, likewise, graphic design in particular, does not escape these considerations.

Regarding the pedagogical proposal of the authors of this paper, the perspective from which technology is understood is consistent with the Critical Technology Theory of Andrew Feenberg (1991). One of the objectives of the area of knowledge "Basic Sciences and Technology" of the 2015 Plan of the Graphic Design degree of the FAUD,

is: "to develop a critical thinking of technology in general that facilitates its understanding as a cultural product, so any decision involved will have social, political and economical consequences" (Higher Council of the UNSJ, 2015, p. 91). This objective is an indication of the search for an education whose purposes are to clarify the values at stake in any technological choice.

The place of design in the field of technology and its understanding from the framework of the critical theory allows highlighting and questioning the philosophical and political principles on which the designer's decisions are based, i.e., the principles that can justify his actions. Likewise, in light of the implicit content of the products generated said principles make the designer's responsibility ostensible. In other words, they allow visibility to the fact that "design is not simply an ornament of cultural life but rather one of the practical disciplines that always embeds values in its actions of transforming abstract ideas into specific products" (Buchanan, 2000, p. 38).

In this context, it was important to inquire on the students' conceptions of technology and its relation with design when choosing to enroll in Graphic Design studies. Knowing the initial state of thought of the students when choosing their vocation and comparing it with what they achieve while advancing in their studies would allow revealing and discerning the ideologies implicitly transmitted by our pedagogical practices and, in some way, the efficiency of these practices will allow to achieve the expected goals.

Since "science and even less technology cannot be taught without putting into practice ideological values and assumptions" (Fourez & Mathy, 2005, p. 205), no teaching practice can be considered neutral. In a technology class "[…] one also learns how to represent the bonds between knowledge and society and one is constantly confronted to discourses with an ideological dimension" (Fourez, 2005, p. 12). Therefore, a team of research professors of the B. A. in Graphic Design of the FAUD UNSJ presented a research project to be approved and financed by the institution, which was carried out during the 2016-2017 period.

The object of this research was to know and understand the conceptions of technology – and its relation with graphic design – of the applicants and the admitted students in the B. A. in Graphic Design at the UNSJ in 2017. To access the students' conceptions, we resorted to the theory of social representations formulated by Serge Moscovici (1961). We chose this theory to understand the processes of social thought constitution, i.e., the ways through which people, integrating the psychological and the social, construct and are constructed by reality (Araya Umaña, 2002).

Some theoretical considerations

Technology. The critical theory of technology

This theory frames technology within the field of politics and enables a different way to comprehend technological development and the role of its social aspects. From this standpoint, technology is a cultural product and, as such, it cannot be neutral since it expresses both the worldviews as well as the interests of the stakeholders that participate in its design. From this perspective, it is understood that "[…] the tools we use mold our way of living in modern societies where technique has become generalized" (Feenberg, 1999, p. 2).

Its development is not autonomous, but there has always been a variety of possible technologies and paths toward progress among which to choose. This entails understanding that a technological system conditions and limits the possible ways of organizing society (Fourez, 2005). Hence, the "design of technology is consequently an ontological decision full of political consequences" (Feenberg, 2000, p. 22). As corollary, from the perspective of the critical theory, it is an attribution and a right of citizens to exercise control over the decisions of technological order that affect their present and future through democratic participation (Giuliano, 2008).

We understand that the critical theory enables a reflection on technology in an extensive context and forms an alternative thinking to the dominant technological rationality. It opens the possibility to incorporate notions such as common welfare, social justice and equity in the assessments of their development, and allows understanding that from the design of artifacts and systems, it is possible to impact the existing social order.

Technology from other standpoints

From an instrumentalist approach, technology is conceived as a neutral media, which does not require any particular philosophical explanation or justification. From this standpoint, technology is independent from the social and the political, because it is not considered a cultural product but rather a neutral tool that can be used for different purposes and said purposes can be good or bad (Feenberg, 1991).

For Feenberg (2002), the instrumental perspective offers a vision of technology that is most accepted from common sense and which is based on the idea that "technologies are tools ready to serve users' purposes" (p.24). This standpoint is functional for technocratic systems.

From the determinist standpoint, besides affirming the neutrality of technology, it is understood that technological development is linear and it determines in a natural and inevitable way the path of social and material progress (Giuliano, 2008). That is, anywhere all the time, the development of technology, that represents progress, leads to the same result.

Since this natural development is considered autonomous, the possibility of controlling it remains invisible (Giuliano, 2013). This standpoint excludes man by placing him in a passive role of spectator from the moment that he cannot influence the development or content of technology.

About the theory of social representations

Social representations, their conceptualization

The theory of social representations is based on the premise that all reality is represented, i.e., that it is conditioned by history, the ideological and social context that surrounds subjects. Reality is a product of its appropriation by the individuals of a group, of its reconstruction in a cognitive system and its integration in the system of values itself. In the framework of this theory, social representations constitute "a functional vision of the world that allows individuals or groups to give meaning to their conducts, understand reality through their own system of references and, thus, adapt themselves to it and define their place in it" (Abric, 1994a, p. 14).

Thus defined, the representations affect a specific form of knowledge, i.e., common sense knowledge, socially constructed and shared within different groups (Jodelet, 1986). These are made up from the interaction between the subjects and their relation with the discourses that circulate in the public space and involve both cognitive and affective aspects. They have a practical objective because, as before mentioned, they function as a system to read reality and as a guide for action in everyday life (Jodelet, 2011).

However, they do not only guide the behavior of individuals of a group, but also "remodel and reconstruct the elements of the environment in which the behavior takes place" (Moscovici, 1979, p. 33). Hence, social representations "[…] are at a crossroad between the psychological and the social, articulating social relations with cognitive aspects of the language and communication" (Castorina, Barreiro and Toscano, 2005, p. 217). They are always representations of something (they constitute the object of representation) and belong to a specific social group. They have an implicit character since the individuals are not aware of their existence as representation and they are socially shared collective productions.

The structure of social representations

In this paper, a structural approach of social representations was taken (Abric, 1994a), which allows considering that a social representation is made up by a body of information, beliefs, opinions and attitudes of a certain object. These elements are organized and structured in such a way that they constitute a specific type of cognitive system. From this approach, every representation is organized around a central core or

central system around which, in turn, peripheral elements are organized and which also make up a system.

This nucleus consists of one or several elements that give meaning to the representation and involve social norms and a value system proper to the cultural and historical context of the group to which said representation belongs. This nucleus or central system "[…] constitutes the most stable element of the representation, that which ensures its perennial nature in changing and evolving contexts" (Abric, 2001, p. 44); hence, its resistance to changes.

The peripheral system depends of the nucleus and consists of schemes and sequences of information. It functions as interface between the central nucleus and the concrete situation in which the representation is developed. It is flexible and plays an essential role in the adaptation of the representation to changes of context, by integrating new information as well as any transformation of the environment. Thus, it protects the central nucleus of its eventual transformation, since it marginalizes the presence of any element that can question its essential premises, reinterpreting it according to the central meaning or assigning it a character of exception (Abric, 2001). Altogether, the nucleus and the peripheral elements make up a structure that is proper to every representation.

In the descriptive framework, the initial hypothesis in this research was that in the representational maps of social representations of technology, when the students choose to enroll in the Graphic Design degree, ingenuous and reductionist conceptions would emerge, closer to determinist or instrumentalist approaches than to critical approaches.

Method

The research was descriptive and non-experimental in nature. To carry it forward, a combination of methods proper to qualitative and quantitative approaches was used. Triangulation was considered as a valid strategy not only to validate data but also to obtain and process them (Petracci and Kornblit, 2007). Hence, we combined different data collection techniques and the results were analyzed through interrelation.

Population

The population consisted of applicants and admitted candidates to the A. B. in Graphic Design at the FAUD in 2017 (a total of 336 subjects). Two intentional non-probalistic samplings were defined (Hernández Sampieri, Fernández Collado and Baptista Lucio, 2008), trying to include subjects that were going through different phases of the selection process; the common core introductory course to the three degrees of the FAUD and the first common core year of the two design B. A. (graphic and industrial).

The first sample consisted of 17 applicants; they attended the first week of the common core course of the three careers of the FAUD, and they declared their intention of choosing Graphic Design. The interviewees were aged 17 to 30. The median age was close to 20 (19.82), i.e., between 18 and 19.

The second sample (sample 2) consisted of 17 admitted candidates, students that passed the introductory course and attended the second week of classes of the first common core year of the Graphic and Industrial B. A. of the FAUD (excluding the subjects that were in sample 1), who declared their intention of choosing the Graphic Design B. A. The interviewees were aged 18 to 25. The median age was also close to 20 (19.71); i.e., 18. In both cases, all the youngsters expressed their intention of choosing the Graphic Design B. A.

Techniques

The technique of association and word hierarchization (hierarchical evocation). Abric (1994b) includes the hierarchical evocation within a set of associative techniques that allow knowing the content and structure of a social representation. This is based on the verbal production and facilitates the access to elements that make up the semantic universe of the object of representation, since it exploits the spontaneous character and the projective dimension of this type of production (Petracci and Kornblit, 2004).

For Abric (1994b), the central elements that make up the nucleus of the representation have greater probability to appear in the subjects' discourses and verbalizations on the object of representation. A high frequency of appearance of a word in a discourse is an important indicator of centrality, provided this condition is supplemented by a qualitative assessment as the assignment of a certain degree of importance by the subject.

In order for a word or an expression to be considered prototypes, it is necessary to meet two conditions: a) a high evocation frequency; the frequency with which the sentence or word is evoked is high in relation with the average of the median frequency of the total of words or sentences evoked (the average evocation frequency of the word constitutes the indicator); and b) a great importance assigned: the importance of a word is considered high to the extent that situations prevail in which it is placed first in relation to the average order of evocation (the median ranks of the order of evocation of every word constitute the indicator) (Balmaceda, 2012).

Then, meeting both conditions (elevated evocation frequency and elevated importance assigned) allows assuming that the subject confers greater symbolic value to an evocation. On the other hand, lower frequency and lesser relevance imply a progressively lesser symbolic connection.

The fusion of the average evocation frequency of the set of words with the importance of the arithmetic mean allows the construction of Cartesian graphs. In them, the location of the words or sentences in each one of the quadrants reveals different degrees of centrality (Abric, 2003 quoted by Wachelke, 2008) as shown in Figure 1.

The words and sentences that are frequently evoked and weighed as of greater importance appear in quadrant 1 of the Cartesian graph and make up the nucleus of the social representation. In the second quadrant (First Periphery) words that are evoked at a high frequency emerge but they are assigned little relevance. In the third quadrant, elements considered innovative or opposing are located since they correspond to the words that are quoted less frequently but are assigned great relevance. Lastly, in the fourth quadrant, called second periphery, appear words or sentences that are evoked less frequently and which are considered less relevant (Aparicio and Balmaceda, 2015).

	Low frequency	***High frequency***
High relevance	**Contrasting elements** Quadrant 3	**Nucleus** Quadrant 1
Low relevance	**Second periphery** Quadrant 4	**First periphery** Quadrant 2

Figure 1. Structure of a social representation
Source: Aparicio & Mazzitelli, 2008a; Aparicio & Mazzitelli, 2008b.

One of the virtues of this technique is that through a lexicometric data analysis the structure and the central field of the representation can be reconstructed from the production of the subjects themselves. Since being prompted in making evocations and in assigning an order of importance to their own words, entails a cognitive reflection work (Balmaceda, 2012).

Drawings

For Abric (1994b), drawings and graphic registries are an adequate mean to facilitate the expression of concepts, mainly the non-verbalized ones, since they encompass "a structured and organized set around central elements or meanings that allow identifying the content and formulating hypotheses on the central elements of the representation"

(p. 58); more so, if the drawings are accompanied by a verbal explanation that anchors their meaning.

The analysis of the denotation and connotation of the content of drawings made by the subjects from a certain inductor term (evocator) in parallel to the hierarchical evocation, can contribute to a better reconstruction of the structure and the central field of the representation; all of this based on the cognitive production of the subjects themselves.

Semantic differential

The semantic differential technique facilitates inquiring about attitudes, motivations, beliefs and other phenomena related to the object of representation. This technique offers the subject the possibility to evaluate an attitude object based on a set of bipolar adjectives. In order to inquire about opinions on technology, a five-item differential and six qualification possibilities were designed, which would allow expressing the level of agreement with different enunciations (differential 1).

These enunciations were developed in pairs, maintaining their coherence with opposing philosophical positions against technology (e.g., critical theory against instrumentalism/determinism). In order to apply it, we asked the subjects, after reading the enunciations carefully, to put a cross in the box closest to one or the other enunciation, according to their level of agreement.

To inquire about the possible relation students found between graphic design and technology, a second seven-item semantic differential was designed (differential 2). In this case, the interviewees were requested to assess the degree of similitude between a graphic designer and different professions on a scale of six possibilities from "very similar" to "very different".

Results

Hierarchical evocation

The data were processed by means of a lexicographic analysis. Words and sentences evoked were analyzed and, taking into account the explanations written by the subjects, a glossary that gathers synonyms or similar meanings was developed. This glossary falls into six inclusive categories of different subsets of words and sentences:

- **Computational Technology and Cellular Telephony** (A). All the words and sentences referring to digital technologies, more specifically those related to communication, that, after being explained, connoted

consumption objects such as: *cellphones, smartphones, computers, applications, communication, software*, among others.

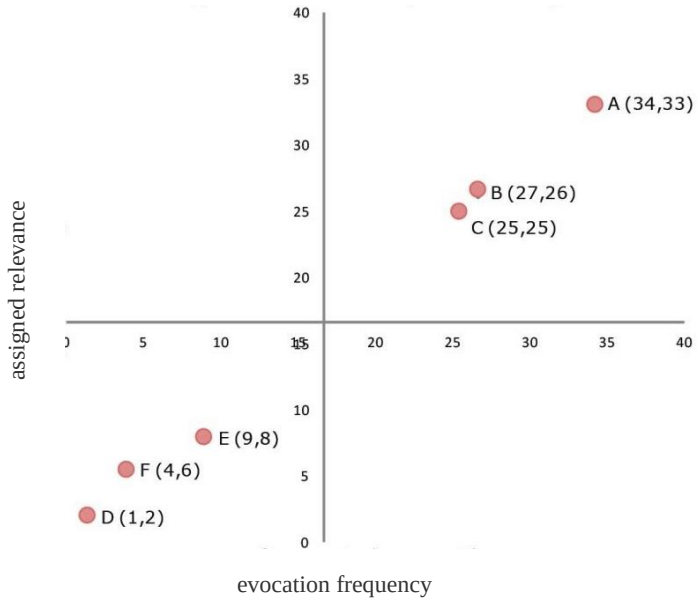
- **Immediate Wellbeing** (B). All the words and sentences that referred to technology associated with comfort and wellbeing, and more specifically to time saving as part of this wellbeing: *quickness*, "time saving", "facilitates life", *functionality*, *advantages*, "better life quality", among others.
- **Globalized Progress and Innovation** (C). All the words and sentences that referred to the development of technology as an advancement independent from human will. That is, words assigning a positive and autonomous character to technology: *advance, advanced, modern, important, innovative, progress, evolution, future*, among others.
- **Moral Assessments** (D). All the words and sentences that referred to critical judgments and more specifically related to an environmental awareness: *sustainability*, *environmental awareness, product improvement*, among others.
- **Apocalyptic Vision** (E). All the words and sentences that referred to technology as dangerous to man, whether because of its possible dependence or its autonomous development as: *"technology, enemy of face-to-face communication", "we can't live without technology", time, communication, distraction, dependence, contamination*, among others.
- **Necessary Conditions and Activities Associated to their Existence** (F). All the words and sentences that referred to the conditions deemed necessary to the existence or development of technology: *creativity*, *imagination*, *knowledge*, *intelligence*, *exploration*, *science*, among others.

The evocation frequency averages and the importance assigned were calculated by detached categories. The results allowed the construction of Cartesian graphs where the "X" axis corresponds to the evocation frequency and the "Y" axis to the importance assigned to each one of the categories. For sample 1 (applicants to enrolment) the results are shown in Graph 1.

The first quadrant that corresponds to the nucleus of the social representation consists of three categories. The first is A (computational technology and cellular telephony) (34, 33). The B category (immediate wellbeing) (27, 26) gathers the terms and sentences associated not only to comfort but also to the speed at which technology would facilitate reaching said wellbeing.

The third category in the nucleus, very close to the previous one, is C (globalized progress and innovation) (25, 25); it includes all the terms from of which a strong association between technological development and social progress or improvement for society can be inferred.

Quadrants 2 and 3 seem empty. Quadrant 4 corresponds to the second periphery, and consists of the remaining categories. Category E (apocalyptic vision) (9.8) presents higher evocation frequency in this periphery, which gathers all the references to negative aspects of technology with emphasis on those derived from the subordinate role of the human being against a specific technology or of the possible autonomous development of technology.

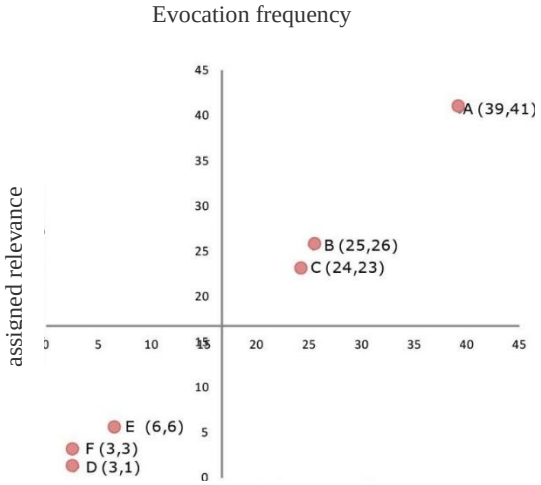


Graph 1. Structure and content of social representation on technology of the subjects of sample 1 (applicants)
Source: developed by the author.

This category includes words referring, in particular, to hard technologies with a high level of automation, implying a completely external subject, man as spectator without interfering in its control. Lastly, the remaining categories appear (with low evocation frequency and little importance). One of these is F (necessary conditions and activities associated to their existence) (4, 6), which involves words associated with creativity, imagination or knowledge with the necessary requirements to develop technology.

This would show that, to a lesser extent, these subjects relate technology with the human intellect or consider it a product of the human intellect. The other category is D (moral assessment), with the lowest frequency and the least relevance (1, 2), it gathered all the judgments on technology with particular emphasis on possible environmental consequences of the technological development. As for sample 2 (students entering the first common core year), the results are shown in Graph 2.

As noted, the structure and the content of social representations of the subject that passed the introductory course are practically identical to those of the applicants to enrolment (sample 1). In the nucleus of the representations of these subjects, three categories emerge once more: A (computational technology and cellular telephony) (39, 41); B (immediate wellbeing) (25, 26); and C (globalized progress and innovation) (24, 23) with coordinates very similar to those of the previous sample. The same occurs with the place where the remaining categories appear: categories E (apocalyptic vision) (6, 6); F (necessary conditions and activities associated with their existence) (3, 3); and D (moral assessments) (3, 1) appear in very similar relative positions as those of the previous case.



Graph 2. Structure and content of social representations on technology of the subjects of sample 2 (admitted students)
Source: developed by the author.

Drawings

First, the interviewees were requested to draw what came to their mind when thinking of technology. In this case, it was clarified that what was relevant was what they expressed in the drawing and not the quality of it. Next, they were requested to explain in writing the meaning of what they had drawn. The research team also registered the sayings of the subjects while they were drawing as to supplement the written and plotted data.

The drawings were examined twice. First, a descriptive analysis of the objects drawn was conducted. The categories emerged were grouped and the frequencies at which the subjects drew them were calculated. In this case, the analysis was limited to a denotative level, hence, the objects were computed in isolation, ignoring the relations

between them and taking as a whole the cases where the drawing constituted an abstract composition.

This analysis showed that most of the subjects of the two samples (89%) drew screens, cellphones, computers or components of the latter (Chart 1). This result is very consistent with the categories identified in the nucleus of the representation (first quadrant) based on the application of the hierarchical evocation technique, where computational technology and cellular telephony were associated to wellbeing and social progress.

	Sample 1		**Sample 2**	
Total subjects	18		17	
Categories	Frequency	%	Frequency	%
Computational technology and cellular telephony	16	88,9%	14	82,4%
Devices and tools	1	5,6%	3	17,6%
Human figures	2	11,1%	1	5,9%
Abstract representations	1	5,6%	1	5,9%
Other	1	5,6%	0	0,0%

Chart 1. Percentage of subjects who drew objects belonging to different categories
Source: developed by the author.

The subjects seldom drew appliances or tools. There were two cases in sample 1, and one case in sample 2, where the human figure appeared in relation to technology. Abstract representations were also scarce in the drawings of both samplings. Regarding the generalized absence of human figure in the drawings on technology, we inferred that it could be related to the paradigms or approaches from which technology is understood. If technology is understood from a determinist perspective, the role of the human being is that of a spectator that has not interference whatsoever in its development or its

content. From this standpoint, both artifacts and systems always sustain and reproduce the preexisting social order without the subject intervening in them.

Semantic differentials

Differential 1 had five pairs of contradictory enunciations (opposed) among them, and the subjects were requested to express their level of agreement with one or the other pole. Contrary enunciations were those shown in Chart 2.

The results were analyzed for each one of the samples. Every choice was converted into a positive or negative number according to the closest pole, as mapped in Figure 2. The scores assigned for every pair of enunciations were added. In order for the null responses not to alter the results, the sum of the total number of responses was divided, i.e., the average valid responses were considered.

Polo I (enunciations consistent with Critical Theory of Technology)		**Polo II (enunciations consistent with deterministic and/or instrumentalistic standpoints toward technology)**
If a technology has a negative impact, society should be able to decide wether to implement it or not	e	Negative effects of a technology can be corrected through other technology
The positive and negative effects of technology are not always balanced	d	There is always balance between the positive and negative effects of technology
The criterion to access a technological development depends on the perspective. Ad advantage for some may be a disadvantage for others	c	The best criteria to access a technological development are low production cost and its reported advantages
The possible applications of a technology are conditioned from the beginning of a project	b	Technology itself is not good or bad. This depends on its application
The development of technology can be controlled by citizens through democratic participation	a	It is impossible to stop the development of technology

Chart 2. Pairs of contrary enunciations of semantic differential 1
Source: developed by the author.

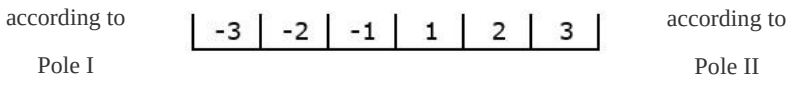
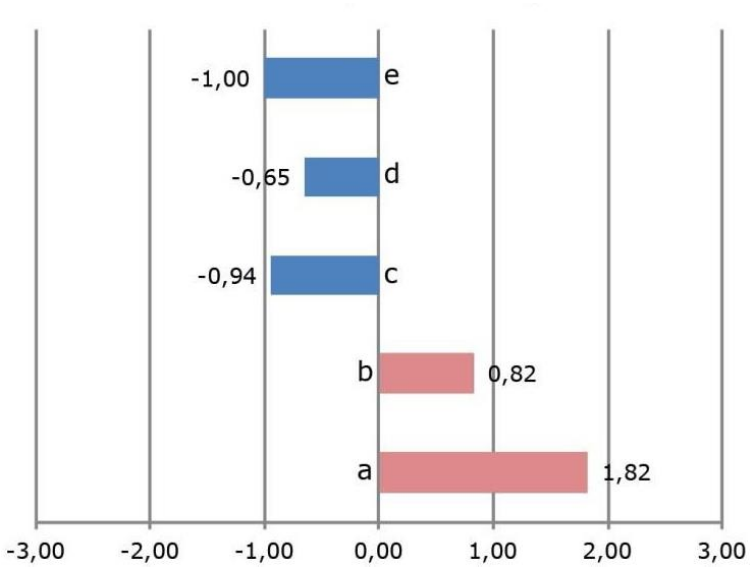
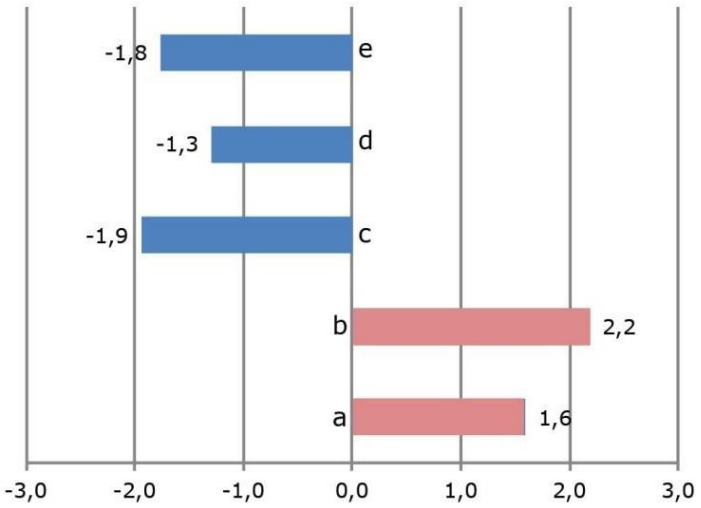


Figure 2. Reference with which the escalation of differential 1 was processed
Source: developed by the autor.

In both cases, for sample 1 (Graph 3) and sample 2 (Graph 4), the preference for enunciations 3, 4 and 5 of pole I showed a great inconsistency with the predominant agreement with enunciations 1 and 2 of pole B.



Graph 3. Level of agreement with enunciations evaluating technology
Sample 1: applicants
Source: developed by the author.



Graph 4. Level of agreement with enunciations evaluating technology
Sample 2: admitted candidates
Source: developed by the author.

In other words, if we consider that technology is constantly advancing and that its progress is impossible to avoid, which in itself is not good or bad, depending on the use we make of it, it is impossible or at least unrealistic that society can establish criteria to assess beneficial or detrimental effects and let alone decide if technology is going to be developed or not.

By conducting a more detailed analysis, we notice that for some enunciations, such as 2) and 3), opinions are reinforced after the introductory course, while the opposite occurs in others such as enunciation 1). The choices of the applicants are closer to the center (i.e., in an intermediate position) in the case of neutrality of technology (enunciation 2), and they are more convinced once they enroll in the degree. In the opposite situation, the conviction of technology autonomous advancement is stronger for the applicants and it becomes weaker for the admitted candidates.

Differential 2 has seven items and a scale of six possibilities between poles: very similar +3) and very different (-3) (See Figure 3). The items were professionals from different fields of study: graphic artist, social communicator, creative publicist, technologist, scientist, craftsman, computer specialist and other.

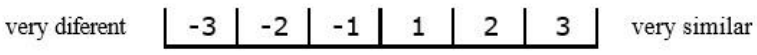


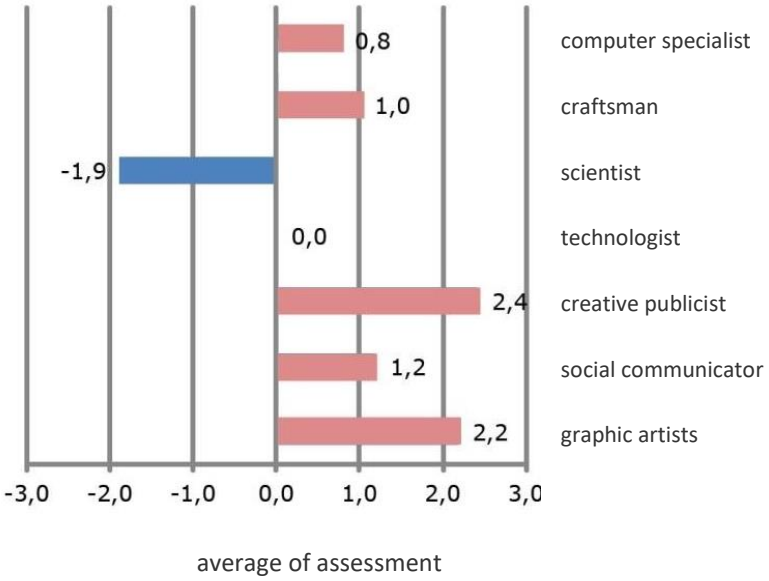
Figure 3. Reference to process differential 2
Source: developed by the author.

The results were analyzed for every sample. The sum of the scores assigned was done for every professional. In order for the null responses not to alter the results, the sum was divided by the total number of responses, i.e., the valid response average was considered.

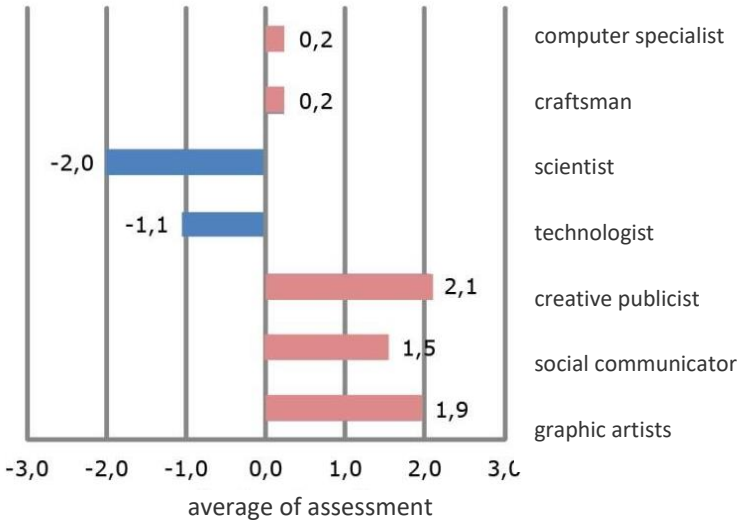
By analyzing all the responses of sample 1 (See Graph 5), it is clear that these subjects consider graphic designers, to a certain extent, similar to the rest of professionals, to the exception of scientists and technologists. In the case of technologists, the opinion is neutral; they are not similar or different, which could make us think of a lack of knowledge of the meaning of the term. The professionals considered more similar to a graphic designer are the creative publicist (average of 2, 4) and graphic artist (average of 2, 2), professionals who are clearly acknowledged as non-scientists.

As for the subjects of sample 2 (See Graph 6), we notice that differences are more reinforced than similarities. Interviewees consider that a graphic designer is very different from a scientist (-2) and, also to a technologist (-1, 1).

Graphs speak for themselves, for these subjects, there is no obvious relation between a designer and a technologist. The work of a designer would be dissociated from technology and also of science. The results are consistent with the structure of their social representations.



Graph 5. Similarity of a graphic designer with other professionals
Sample 1: applicants
Source: developed by the author.



Graph 6. Similarity of a graphic designer with other professionals
Sample 2: admitted candidates
Source: developed by the author.

Conclusions

First, we can say that the presence of the "computational technology and cellular telephony" category in the nucleus of the social representation on technology of the subjects of both samplings, together with the majority of content denoted by the drawings, reveal a generalized vision that reduces the universe from the technological to the computational and especially to products and services that serve communication (screens, cellphones and the Internet).

The two other categories in the nucleus of the representation, "immediate wellbeing" and "globalized progress and innovation", as well as the generalized agreement with enunciations 1 and 2 of pole II of the semantic differential ("Technology is constantly advancing and it is impossible to avoid it" and "Technology in itself is neither good or bad, it depends on the use we make of it") are proper of a consistent standpoint with a determinist position against technology, since it is considered neutral or free of values and its development is absolutely independent of human doing or will. That is, man is not present in technology. The generalized absence of the human figure in the drawings on technology is also consistent with this position. In addition to this, evocations referring to "technological advances" take for granted that all development is socially positive.

The "apocalyptic vision" category that emerges in the second periphery in both samplings could also be related to the notion of autonomous development of technology, whose negative effects, should they exist, would consequently be impossible to control and, hence, considered catastrophic. In both samplings, the "moral assessments" category is also the only one of those identified that could be associated more clearly to a critical position against technology; it appears in the second periphery with low frequency and negligible importance. This reveals that these subjects could not yet construct a critical standpoint.

Second, by comparing the structure and the content of social representations of both samplings, we notice that there are no modifications in the categories present in the nucleus and in the periphery. The only changes are their relevance and frequency and, in all the cases, they remain in the same quadrant. This leads us to believe that the introductory course failed to mark an impression that influences these youngsters' conceptions of technology and brings them closer to the postulates on which the academic proposal of the institution is based.

All of the above allows us to consider the initial hypothesis highly corroborated. That is, the analysis of the youngsters' social representations addressed in this research revealed that the conception of technology is reductionist, insofar as it makes the notion of technology equivalent to one of its subsets: computational technology. In other words, in their conceptions, a particular assumes the place of the universal, hindering a deep understanding of its essence.

Furthermore, these youngsters, in general, conceive computational technology from an ingenuous, instrumentalist o determinist standpoint that leads us to associate the idea of technological advancement with a path toward greater wellbeing. For Feenberg (1999), the notion that technology is constantly advancing is associated with the belief that progress is indisputably linked to the advance of humanity toward happiness. Likewise, for this author, the notion of neutrality of technology is linked to the assumption that the purposes that technology serves are permanent characteristics of our biological constitution.

The standpoint of the subjects interviewed undoubtedly hinders them in assuming themselves as protagonists of technological development and relegates them to the role of spectators or uncritical consumers of technological products. Therefore, it is understandable that it is difficult for them to understand graphic design as a technological discipline, and their work as that of a technology producer; let alone think that they can assess the consequences of their action from a standpoint such as the critical theory of technology.

The unveiled situation constitutes a challenge for teachers as it challenges us in working for an education that fosters the transition toward more critical and committed views of technology; views that show that technologies can function as both

emancipation and oppression factors (Fourez, 2005, p. 13), of which, as future graphic designers (technologists) trainers, we are responsible in making known, for what "[…] human beings are and will become is decided in the shape of our tools no less than in the action of statesmen and political movements" (Feenberg, 2002, p. 22).

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