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ABSTRACT
We investigate youths' conceptualization of social robots. Informed by Schudson's theory of the potency of the cultural object, we conducted two studies. The first study centered on essays on social robots written by bachelor's and master's students. The second study centered on prototypes of social robots built by small groups comprised of same students. The essays and prototypes were content analyzed. The results confirm that social robots embody all five dimensions that characterize cultural objects. However, to fully understand this peculiar cultural object, anotherdimension needs to be introduced: dynamicity.

KEYWORDS
Conceptualization; content analysis; cultural object; dynamicity; Italy; robots; social; youth

Our study investigates youths' conceptions of social robots.
It complements previous research carried out with children (Fortunati et al. 2014; Fortunati et al., 2015a) with a different theoretical perspective and participants aged 18 years and older.
The youth today are a particularly interesting population to study as they are in an ambivalent and even paradoxical situation in industrialized countries (Fortunati, Taipale, and de Luca 2017). They are facing processes of both empowerment and disempowerment.
They are digitally more powerful but socially weaker than older generations (unemployment, precarious jobs, etc.). Despite this problematic situation, the youth have vitality because they are future-minded (Moscovici 1976) and have structurally more enthusiasm for the new, the novelty, and innovation.

In the case of robotics, on the one hand, their imaginations are nurtured by stories and imagery of robots in the cultural products of our times; on the other hand, they will face in a few years the social consequences of the increased automation both in industry and the sphere of social reproduction. Investigating their conceptions of social robots and their awareness of the increasing penetration of robotics in many areas of everyday life thus becomes critical.
While in earlier studies social representation theory was adopted as an overarching framework to study children's imaginations of robots, in the present investigation, Schudson's (1989) theory of the potency of the cultural object is used to understand the youths' conceptions of social robots.
According to this theory, a cultural object has five dimensions:

1. Retrievability: the ease of finding the cultural object, acquiring it, and keeping it.

2. Rhetorical force: the persuasiveness of the cultural discourse it conveys.

3. Resonance: the extent to which it is in tune with existing opinions and structures, even when it is original and has significant rhetorical force.

4. Institutional retention: the extent to which it can be institutionalized, enter into the rituals, practices, and operational processes of production and consumption in everyday life.

5. Resolution: the impact it has on collective behavior and actions.

The more an object expresses these dimensions, the higher its influence and potency are on a societal level.
Our empirical study verifies if this theory is still applicable after 25 years and to what extent it works for a peculiar cultural object—social robot.
More precisely, our purpose is not only to examine whether or not the theory of cultural object can be applied to the social robot but also to investigate whether and how the social robot, in its turn, may prompt reshaping of this theory.

Knowing what the youth have to say regarding social robots is important for designing social robots the "right" way for users with different needs and preferences—children, elderly, men, women, technologically challenged, and so on (Enz et al. 2011; Frennert and Ostlund 2014; Weiss et al. 2010).

This is critical because, in contrast to industrial robots, social robots need to be able to "interact and communicate among themselves, with humans, and with the environment … operate according to the established social and cultural norms" (Cabibihan, So, and Pramanik 2013, 307). Engineers and programmers should be aware of the cultural assumptions that influence social robot design and develop social, psychological, communicative, and cultural competences necessary for social robots to "live" with humans (Sabanovic 2010).

When we look at the societal understanding of social robots, we have to take into account that these cultural artifacts are still far from the everyday experience (Eurobarometer 2012; Taipale et al. 2015).

As we are at the dawn of their social use (Sugiyama and Vincent 2013), the majority of the European population conceptualizes robots on the basis of cultural inputs such as science fiction literature, movies, and cartoons and their first interactions with robots are also largely informed by them.

Several research projects have already explored the practices of robot use, both in industrial settings (Bicchi and Tamburrini 2015) and in the domestic sphere (Cavallo et al. 2014; Syrdal et al. 2015).

Also, empirical studies have begun to investigate how social robots are—or could be—integrated into domestic life (Fortunati, Esposito, and Lugano 2015; Sugyiama and Vincent 2013; Vincent et al. 2015).

With this investigation, we seek to contribute to the understanding of how youth look at social robots.

The youth are increasingly exposed to initiatives for spreading knowledge about robots in schools[1] and universities, as well as in the social sphere.

Further, in DIY (Do It Yourself), Fablabs, Makers, and other such movements, the youth are the engine in use of technologies such as 3D printers to build humanoids[2] and other types of robots.

Moreover, at home, this generation is starting to directly experience the introduction of domestic robots (e.g., floor cleaning, cooking).

Thus, the way they see social robots today is likely to affect not only the meanings they attribute to them but also the attitudes, behaviors, and practices they will have tomorrow (Fortunati 2013; Fortunati et al. 2015b; H€oflich and El Bayed 2015; Katz, Halpern, and Crocker 2015; Taipale et al. 2015; Vincent et al. 2015).

From the current ambivalent situation, we are moving toward a critical phase where we will have to face and resolve social and ethical issues related to the design and use of social robots in everyday lives (Li, Cabibihan, and Tan 2011) and where we will see more and more interconnections and conflicts between social imagination, everyday practices, and technical knowledge about robots. From these premises, we suggest that the time is ripe for an exploration of how the youth shape the image of social robots. The research questions guiding this study are as follows:

Q1: What types of conceptualizations of social robots university students following a scientific course of study are expressing?

Q2: What are their visions and reflections on social robots?

Q3: Are social robots veritable cultural objects?

The rest of the discussion is organized as follows: in the next section, we discuss the notion of cultural objects, and then, in the following sections, we introduce two studies we conducted. The final section is dedicated to the discussion of the main findings, their strong and weak points, and the issues left open for future research.

Theoretical framework: Social robots as cultural objects

The sociological approach to the object received its baptism of fire in the 19th century with Marx's analysis of the industrial production of the object as well as its circulation and consumption. For Marx, any object must be seen as a commodity that has two qualities: the use value and the exchange value. However, after this great start, the most vivid theoretical reflections on the object come in the second half of the last century from semiology and sociology. Roland Bartes in 1957 publishes Mythologies in which he argues that, in order to understand society, it is necessary to delve into the contemporary myths and symbols attached to the objects of everyday life. Baudrilliard (1968) claims that to capture the Zeitgeist of contemporary societies we need to focus on the system of everyday objects. To analyze this system, he chose a semiological model, the only one capable—in his view— to capture the meaning structure as well as the communicational structure of the modern commodity.

Then, the debate is advanced by anthropologists such as Douglas and Isherwood (1979) who deal with a neglected part of the Marxian analysis: the world of consumption. They talk of goods and their role in building social alliances and also in creating social alienation. In 1986, Appadurai builds upon the anthropological and sociological traditions, weaving them together. Drawing on Marx and also Simmel, he proposes that objects have social lives, in the sense that not only objects are socially created but they have also a particular kind of social potential.

It is exactly this social potential that evokes several different types of exchange: the exchange value, the barter, but also the gift. These different types of commodities exchange continue to persist in contemporary societies (barter is even increasing). Kopytoff (1986) introduces another interesting understanding of objects—biography of the object. He points out that things move in and out of the commodity state. In a similar vein, Miller (1987) advances the notion of material culture. With the Marxian definition of commodity beginning to lose its once tight grip, Appadurai (1986) continues: the commodity is reduced by users' agency to a particular phase and a specific context. This creates a tension between the frameworks and norms that are embodied in the commodity and the tendency on the part of users to breach these frameworks. Following this debate, Latour (1994) invites sociologists to rediscover the hidden role of the object in the social. He, in fact, claims that sociologists risk remaining without the object if they continue to insist on building the social only with the social and do not recognize that objects are not only means but also mediators of the social interaction. After Latour's essay, the object receives increasing attention in sociological theory. We cannot but cite at least Knorr Cetina (1997) who analyses sociality with objects or the object-centered society, pointing out the increasing tendency toward objectification in modern societies.

She explained this in terms of an "increased orientation towards objects as sources of the self, of relational intimacy, of shared subjectivity and social integration" (32). Then we see the development of the theoretical framework called new or neo-materialism for exploring how "matter comes to matter" (Alaimo and Hekman 2008; Barad 2007; Bennett and Joyce 2010; Barrett and Bolt 2013; Coole and Frost 2010). New materialism wishes the great return from words to things and is moved by a genuine interest in what people really do with technologies (Bennet 2010, but first see Bourdieu 1977). This debate offers a rich theoretical discourse on the multidimensional life of objects and provides valuable points of references.

However, we needed a safe and focused guide for an empirical exploration of our object of study: the social robot. For this reason, we decided to turn to another prominent tradition within the sociology of culture, which has addressed the notion of the cultural object (Crane and Bovone 2006; Griswold 2013; Poster 2004; Woodward 2001). For this investigation, we adopted Schudson's (1989) theory of the potency of cultural objects because we needed an approach that focuses on the salient characteristics—five dimensions detailed earlier—that a cultural object must have as such.

According to Schudson, a cultural object is more powerful "the more it is within reach, the more it is rhetorically effective, the more it resonates with existing opinions and structures (without disappearing entirely into them so as to have no independent influence to exert), the more thoroughly it is retained in institutions, and the more highly resolved it is toward action" (175). He adds that a cultural object "helps provide a language for discussing the differences in influence of different aspects of culture" (175).

There are a significant number of studies on social robots reported in the literature that seem to give support to this assumption. We will review them while analyzing the potency of the social robot as a cultural object in relation to the five dimensions indentified by Schudson.

Retrievability. Social robots are quintessential cultural objects with dual aspects: on the one hand, they represent popular entertainment; and on the other hand, they represent a very important body of scientific and technological knowledge (Pfadenhauer, Sugyiama, and Ess 2015). In other words, social robots are both fun and socially relevant.

They are present in almost all domains of the cultural world: from cinema to television, from books to cartoons, as well as toys based on popular entertainment franchises.

At the same time, there is an extraordinary flourishing of media discourse on social robots and of educational initiatives.

An earlier study carried out with 740 children attending elementary and secondary schools found that when asked "Do you know cartoons or other television programs or movies with robots?" the children were able to name 125 different media products (Fortunati et al. 2015b). This is reflective of the presence robots have in the popular culture, making them cognitively memorable and easily retrievable.

This dimension is highly relevant as "retrievability is a manipulable function of culture because people's attention is a scarce resource" (Schudson 1989, 164).

Rhetoricity. Social robots are cultural objects of extraordinary rhetorical force, because they are rooted in the most archaic structures of the imagination of the humankind—both as myth and archetype (Buxton 1994; Graves 1955; Fortunati 2013).

Interestingly, Aristotle liked thaumata (the ancient robots) for their capacity to provoke reaction and to stimulate theoretical questions. He therefore invited others to love them because human intelligence, he said, has always appreciated the ability to measure its own excellence against mechanisms (Lanza 1989). The robot is a trope that regularly reappears in the history of culture. However, it is important to note that with modernity there has been a change in this trope. The contemporary trope of the robot has lost its symbolic power, psychological function, and meaning, and gotten reduced to an exchange value, which is a commodity.

The standardization of narration, due to the industrialization of processes of intellectual labor, has simplified characters, plots, and narration techniques (Abruzzese 1979).

In this simplification, the trope of the robot has been completely overturned and the robot begun to circulate with the regularity of consumable goods.

Nowadays, the trope of the robot is capable of passing through different media and reemerging by means of a new language as a transmedia product.

The shift from the modern, separated cultures to the unified culture of the postindustrial and globalized society has led to the elaboration of a mainly iconic, universal, transcultural, transsocial, and transmedia robot.

The transmedia nature of contemporary robots of course strengthens the rhetorical force of this trope. Bakardjieva (2015) analyzed how the trope of the robot is actually nurtured by the processes of automation in the web (see also Esposito, Fortunati, and Lugano 2014; Fortunati, Esposito, and Lugano 2015; Vincent et al. 2015).

If we compare social robots to other similar cultural objects, such as imagery of monsters and supernatural entities, robots turn out to be the benchmark for excellence in the production of visual products because they bring forth a unique charm. Resonance.

Social robots resonate with the general understanding of the public that robots use is and will not be free of tensions. This understanding is evident in debates on job markets and welfare, as well as on education and ethics (Eurobarometer 2012; Fortunati, Esposito, and Lugano 2015; Taipale et al. 2015). Institutional retention.

Today, social robots are supported by industrial sectors (Dekker, Salomons and der Waal 2017) and institutions, which fund major research programs.

They also fund educational initiatives on social robots in various types of schools and academic courses and also those directed at the general public. Resolution.

Social robots have high resolution, as they are likely to influence attitudes, opinions, emotions, and behaviors in material, immediate, and measurable ways, e.g., the large number of newspaper articles on robots that have been published in the last 2 years (Buscato and Steffan 2015).

If we apply to the robot the model Spiro (1966) proposed for the hierarchy of effects, they are operative at all of the five levels in the case of social robots: people come to know about robots, they understand them, they evaluate whether or not robots are good for humankind, they judge if they might be important for them and human societies, and finally, they internalize conceptions of robots such that it is not only cognitively but also motivationally, relevant. In sum, from this analysis, it emerges that robots are a clear example of a cultural object because they fully embody all the five dimensions identified by Schudson and produce a substantial influence on various aspects of culture.

Their existence is profoundly intertwined and resonates with societal debates and cultural tropes, and their institutional and political relevance strongly influences different aspects of society, from individual imagination to social action.

However, none of these earlier studies were designed within the potency of the cultural object framework; these were simply used a posteriori to verify the assumption that robots are cultural objects.

Thus, the time is ripe to produce a true study on social robots as cultural objects employing Schudson's framework.

Methodology

Two exploratory studies were conducted with different methodological tools.

First study

Materials

The first study centered on 41 essays written, as part of an intermediate exam in the Sociology of Communication and Culture class, by students in the bachelor's degree program in Multimedia Sciences and Technologies at the University of Udine and four essays written, as part of an intermediate exam in the Laboratory of Social Robotics class, by students in the master's program in Multimedia Communication and Information Technologies at the same university.3

Procedure

We invited the students to reflect on social robots, without providing them any further instruction on how to write their essays. We were interested in their spontaneous thoughts and their capability to retrieve robotsrelated knowledge. The procedure allowed for more selfexpression and spontaneity of content than a classical written interview.

Analysis

The texts were submitted to qualitative content analysis to identify the most relevant discursive frames (Altheide 1996).

Categories with relatively low frequencies but possible importance for the clarification of certain points were also retained, analyzed, and discussed, as Silverman (1997) recommends. As the analysis advanced, no new categories emerged, showing that informational redundancy had been reached.

We considered each text as a unit of analysis and we coded the themes emerging from the texts (e.g., music, entertainment, and education).

Each thematic category was further matched with the five dimensions suggested by Schudson. This allowed us to trace the development of participants' ideas and views about social robots and to identify the most recurrent features.

The analysis was conducted by three independent judges; categories and inconsistencies were then jointly discussed in order to achieve a thick interpretation of the data.

This mode of content analysis is nonintrusive and flexible (McNeill and Chapman 2005).

The students were expected to be particularly sensitive to the issues related to digital technologies since that was the subject matter of the course they were enrolled in.

Their articulations provide insights for revisiting takenfor- granted ideas in the literature and formulating new lines of research for quantitative studies with more representative samples of the youth.

Materials

The second study centered on 11 projects on social robots undertaken by bachelor's students in the abovementioned Sociology of Communication and Culture class.

At the time the study was conducted, the class had already completed introductory lessons on social robots from a social science perspective.

Procedure

We divided the class into 11 working groups and asked each group (six to seven students) to design a social robot, to provide its technical specifications, and to detail its features and affordances. We were interested in exploring whether, when asked to play the role of an engineer or a designer, the students were able to take into account the sociological awareness and sensitivity previously acquired, or whether the task of thinking in practical terms inevitably would have brought them back to a more traditional I-methodology4 approach.

This task was inspired by Hoflich's (2013) and Hoflich and El Bayed's (2015) works on the figurative nucleus of social representations of robots.

Analysis

The works produced by the students were content analyzed. Due to lack of space, all of the construction details and the intended actions and the interactions of these robots are not included in this summary. For our purposes, we will focus on the broad descriptions of the projects, as well as on the main features of the students' works, especially their innovativeness.

Results

Wewill present the results that emerged fromthe two studies, following the five dimensions identified by Schudson.

First study

Retrievability

Almost half of our participants dedicated their essays to outlining a sort of phenomenology of the applications of robotics to the field of music, a typical field of youth culture consumption.
We further investigated the reason behind this choice and found that the majority of the respondents were amateur musicians, who were already aware of—or easily found details about—robots in music. The robot in music is a "social robot" par excellence because it transforms both the production and the consumption of music—an important part of the public sphere of culture and entertainment and also personal expressivity.

In the realm of music, we see innovation and also increasing automation of taste with algorithms-driven recommendation systems, as Barile and Sugiyama (2015) show in their analysis of the application Shazan©. If we consider some of the main aspects of retrievability (Schudson 1989), we can say that musician robots are highly retrievable.
In particular, two bands of musician robots (Z-Machines and Compressorhead) are salient.
The most popular among our students is the Z-Machines band, which is made of three elements: Mach the guitarist, Ashura the drummer, and Cosmo the keyboard player.
The participants also reported other examples of robot bands that match foreground other aspects of retrievability.

Martina P. described a cheap and accessible technology.
"The Toa Mata Band [created by Giuseppe Acito] is a music band of small Lego [Bionicle series] robots that are programmed to play various instruments.
This band is managed by an Arduino platform, Uno, connected to an iPad.
"5 Here we see economic retrievability.
Federica B. talked of "an orchestra composed of nine flying robots that can play, with a variety of musical instruments (from the organ to the plate and to the guitar),
the theme of the series of James Bond films.
The small helicopters are controlled by a computer programmed with the instructions for the movement of each robot.

" Here we see economic retrievability and also cultural retrievability, as there is a connection to well-known James Bond series films".
Arianna M. reported a project in a secondary school in Mogliano Veneto (less than 100 kmaway fromthe University of Udine), where teachers and students were able to create choreographies of robots dancing with music.
This project is considered important because it succeeded in givingmore
fluidity to the gestures of robots.
In sum, with regards to retrievability, our participants' essays show that robots are not only cognitively salient but are also becoming economically, culturally, and geographically
accessible.

Resonance

Although robotic music is quite new, it has a long story behind it.
Our participants are aware of the cultural relationships between robotic music, music traditions, andtheir personal experience. In fact, several essays reconstructed the history of automation in the field of music.
Francesco B. reported on the stages of automation that preceded the advent of robotics:
… in 50s and 60s, the new typologies of microphones, the pick-up systems, the tape, followed by the tape machine and the console, made it possible to mike any single instrument, to connect the microphone to the console and to record each track on the magnetic tape (later transferred to vinyl by a transfer engineer).

Subsequently, the need was felt to develop machines that could further manipulate the sound. Thus were born the first equalizers and compressors, which have represented the replacement of the ubiquitous, at that time, chambers.

However, only in the 70s was the possibility [introduced] to make a recall of the console settings and synthesizers [were introduced], that is, keyboards identical to those of a piano, but capable of producing an infinite number of different sounds.

Davide G. wrote about the use of the computer in popular music in the second half of the 1970s. He remembered, for example, Giorgio Moroder's role in making computer music known to the general public.

He also provided two examples of seminal music composition software.

The first example, autom@tedVisualMusiC, was compiled in 1999 by the musician Sergio Maltagliati, a visual, digital artist, and programmer.

The first version of this software was able to generate, starting from a simple cell, many complex musical and visual variations. The second example, autom@tedVisualMusiC 1.0, was compiled by Maltagliati in collaboration with Pietro Grossi. This software "is an automatic and generative program that, starting from a simple audio-visual sequence, generates innumerable variations, in which the listener has an important role. Making freely sliding the mouse on the images, one obtains different sound combinations:

the image surface generates different types of color and music."

Riccardo L. recalled the communication protocol called MIDI (Music Instrument Digital Interface) developed in the 1980s. It enabled the British band Muse to send signals to the various instruments and make them play live.

In this way, they were able to have emotional sonorities at their disposal without having many keyboardists on the stage.

Valentina D. introduced the Kraftwerk, a German band that was famous in 1978 for their electronic music.

Their album, "The Man Machine," contains the piece, "We are the Robots." In their video clip, the four musicians were disguised as robots and also actual robots were used in their concert. Another band that expressed robotic movements was the Rockets, a band that made electronic music and used spectacular visual effects.

Rhetorical force

Students' essays expressed a sort of fascination about the possibilities robotics has opened up in the music domain.

Valentina B., for example, described, with admiration, the incredible capabilities of musician robots.

Mach, the guitarist and frontman of the Z-Machines, for instance, has 78 fingers, which "he" uses to hold 12 picks at once.

Ashura has six arms and is able to play 22 percussion instruments at one, and finally, Cosmo projects laser beams from "his" eyes to give the public a "transcendental musical performance."

The superhuman technical capabilities of robots make them powerful and memorable in the eyes of our participants.

It is, however, their extended capacity that makes robots, borrowing Schudson's words, "more vivid, funny, appealing, graphic, dramatic, suspenseful, interesting, beautiful, stunning" (Schudson 1989, 166) compared to other cultural objects.

Institutional retention

Participants refer to cultural institutions, corporations, and key actors involved in promoting robots in their essays. Marta B. introduced with enthusiasm the EMMI (Expressive Machines Musical Instruments), a project started in 2007 by a group of musicians and professors at the University of Virginia to create new robotic musical instruments.

On the other hand, Agnese S. reported that in the United States the Library of Congress refused to issue copyright for music created by robots.
Consequently, the mechanical compositions of Datatron were not marketable.
This is a very crucial point that also concerns the automatic journalistic production of news (O'Sullivan et al. 2017).

Valentina B. reported that the alcoholic beverage Zima sponsored Z-Machines. She wrote: "during one of their performances, when the public raised a bottle of Zima, the Z-Machines started to play with more enthusiasm."
Other students reported that Z-Machines are so exciting that Thomas Jenkinson (also called Squarepusher), universally recognized as one of the leading experts of the drill'n'bass genre, accepted a proposal to write music for them.
The result was the five-piece EP entitled "Music for Robots." The title of the first single is "Sad Robot Goes Funny," and it stresses, as we will see, one of the limitations of robot musicians that almost all of the participants denounced: the inability of musician robots to express emotions, feelings, and moods.

Resolution

Despite such rhetorical force, musician robots still lack resolution.
The capacity of these artifacts to engage the audience in shared ritual actions (e.g., concerts) is limited, and in fact, this was the most debated dimension.
The majority of the students underscored that despite their technical perfection (e.g., no smudging, tempo changes or errors; extended performing possibilities), robots cannot express emotion, and for this reason, they are not really able to engage humans.
Nicola V. said that music "is formed by the notes and emotions, where emotions play the most important role.

" Moreover, robot music cannot have a great impact on the public because it has no soul: "It is for this reason," continued Nicola, "that the majority of musicians denigrate both the music produced by robots and that composed with computers.
" Francesco R. added that robot bands also fail in the ritualization of the relationship with the audience, especially fans, because of their lack of talent.
"My thinking goes to how it would be to ask a robot [for] an autograph … Today we appreciate our singers, bands or musicians because they have studied a lot, for the voice and the talent. Certainly, we cannot say that a robot is talented or has a good voice."
On the other hand, argued Francesco B., robotics "is more successful from a scenic and visual point of view than as regards the sound part, where even today, most of the work is manual." He recalled that "lights capable of moving automatically to the music and scenic automatic systems, and constructed according to the musical performance have been invented and successfully introduced."

Lastly, Tommaso Q. commented on the live conversation between the pianist Roberto Prosseda and the robot pianist Teotronico (pride of the Italian robotic music).6
This student shared the argumentation of Prosseda who "recalls that Chopin exalted the inequality of the fingers, the freedom, the importance of the interpretation and the flexibility of the phrasing of a sheet music: things that a pianist robot such as Teotronico will ever be able to reach." Tommaso Q. concluded that perfection in the execution of the music by robots does not compensate for the fact that it is impossible for them to interpret music.
In sum, robot music can be perfect, but it will always be the same, and, as Tommaso Q. noticed, according to Freud, the compulsion to repeat is an expression of death's drive.
Some participants, however, have a different idea, as they are convinced that robots are not simple executors.

"They are programmed to interact with the audience during their performances," wrote Valentina B. Along these lines, Marta B. pointed to many experiments in this field: MARIE (Monochord-Aerophone Robotic Instrument Ensemble), which is a reinterpretation of the
clarinet, PAM (Poly-tangent Automatic multi-Monochord), which is a dispositive that refers to the sound of an electric guitar, MADI (Multi-mallet Automatic Drumming Instrument), which consists of a series of robotic arms made of various materials (hard plastic, rubber, felt, and brushes), and CADI (Configurable Automatic Drumming Instrument).
There are musicians "who are doing research with the purpose to expand their musical and rhythmic expressivity through remote controlled robots for gaming platforms" (Marta B.).
Martina P. provided another example of musician robots that are not mere executors: "robot band, Dubbed Sound Machines 2.0, a string quintet, which is formed by two violins, a viola, a cello and a double bass, and which consists of five non-anthropomorphic robotic devices that create songs and perform them.

When they receive few improvised notes, a software with algorithms and rules of composition that they contain create and develop an original piece of music.
" Agnese S. provided two more examples. One, engineer Nicolas Sch€offer's 50-meter- Dhigh steel singing structure—generating a changing soundscape day and night—installed in a park in Paris in 1950.
Two, Datatron, created in Vienna in 1956: "a machine whose memory contained simple rules of musical composition, as well as a program to prevent 'not good' melodies.
Built by the mathematicians, Martin L. Klein and Douglas Bolitho, it produced about 4000 melodies [that were] qualitatively indistinguishable from the usual American songs."
The other half of undergraduate students discussed social robots from other perspectives in their essays.

One of these essays resonated with those on musician robots: Giorgia S. talked about the sculptor robot, created by the French company, Lithias.
This machine is able to shape the stone and create any kind of structure.7 Menouantouon
T. provided examples of retrievability and reflected on resolution and rhetorical force.
He also described the interaction with robots currently available for domestic chores as a "master-servant" relationship.
Michele G. and Gessica D. stressed the dimensions of retrievability and retention by linking discussions on robots to those on the Internet. Gessica D. reflected on the bad use of robots on the Internet.
She reported the results of the research Incapsula carried out online, discovering
that 60% of the online traffic is generated by robots or automated programs performing the following tasks, as described by Gessica D.: (1) The evolution of Web-based services, which have generated new kinds of automated functions, (2) the increase of the existing robots, web crawlers, and spiders, that is the network software that scour the sites in search
of information.

There are also malicious robots, such as scrapers, consisting of automated small programs that steal information, duplicate content, and email addresses for spam or identity theft.
Finally, Michele G. observed that humankind has had a long history online in managing relationships through machines, thus the insertion of robots would only be the next step. "Some people, he writes, have relations online with people who have never met before and probably will never meet.
At this point, the difference of falling in love on the part of a human with a machine, similar in all respects to us and indeed in many things even better than us, starts to become a normal thing [that is] entirely acceptable."

Second study

Whereas the first study sought the participants' spontaneous reflections on social robots, the second study asked participants to play the roles of designers and inventors.
This exercise was aimed at exploring whether and how the five dimensions of cultural objects are also applicable in the design process of social robots and, if they are applicable, how so. Table 1 summarizes the main characteristics of each student project, indicating their sphere of use, functions and "skills."

Retrievability

In contrast to the open-ended essays, where students talked mainly of social robots in the music field, all of the projects designed by participants were anchored in their everyday experience rather than leisure activities.
These projects had a specific potential user in mind.
In other words, they did not "design a social robot for all," i.e., strong retrievability.
All of the projects presented different "niche social robots" that were very concrete and detailed. They had to do with housework, elderly care, and public services.
Participants invented a DOG-SISTANT, a social robot in the form of a dog for domestic use.
In a similar vein, HO-BO, a robot that helps people keep their homes in order, was programmed to recognize personal items, room by room, and know where they should be placed.

HO-BO could also fold and reorder the clothes, make the beds, clean floors, reorder libraries, and do dusting. Another robot with a multiarticulated arm, BV-ROBOT, which may be in the view of participants the natural complement to the Roomba, was for work at "high altitudes"—cleaning high shelves and windows, changing light bulbs and carrying small objects.
A second set of projects focused on elderly care at home.
Here too the projects did not seek strong retrievability. DOC-CHAIR is a social robotic chair for elderly people. It is meant to be equipped with devices for temperature, blood pressure, urine, and heartbeat control, as well as back massage functions to tone the muscles.
Other projects were the BLIBOT, which is designed to support people who are visually impaired, and the HELPOLD, an android for helping the elderly with basic housework and to ease their loneliness.

REMIND2ME is a virtual domestic assistant that gives reminders and provides audiovisual entertainment. It could also serve as a platform for medical devices that carry out medical examinations at home and then send the results to the doctor.
ROBOT PRIMER was designed as an aid for persons affected by Alzheimer's disease. It was inspired by Paolo Dario's idea of wearable robots.
It takes the form of a clock: simple to wear and always on the people needing care.
A third set of projects focused on public areas. Two projects deal with public services.
AIR-CLEANER was for cleaning the air in public areas.

It is meant to detect hazardous or harmful gases, alerting others with audible and visual alarms, as well as measuring the presence of humidity, CO2, deodorant sprays, and insecticides. TRASH-DIVIDER was for the disposal of waste. BAROBOT was a robotic assistant for venues with large turnouts such as discos, clubs, and music events.
The BAROBOT was meant to stand alone at the counter and serve customers their order.
It was the only project directed at the leisure sphere. It is worth noting that, in July 2016, at the Expo in Milan, this kind of bar-robot was in use.

Table 1. Main characteristics of student projects.

Project name	Sphere	Function	"Skills"
DOGSISTANT	Domestic use	Life companion	Dog form with a multifunctional table top
HO-BO	Domestic use	Housework	Recognizes items and spaces
BV-ROBOT	Domestic use/elderly care at home	Housework at "high altitude"	Multiarticulated arm with cutting-edge technology
DOC-CHAIR	Elderly care at home	Health monitoring system/telemedicine	Robotic chair with monitoring devices (e.g., temperature, blood pressure, urine)
BLIBOT	Blind people care at home	Support (writes, reads, cooks, and does housework)	
HELPOLD	Elderly care at home	Housework/life companion	Android
REMIND2ME	Domestic use/ care at home	Reminders/entertainment/telemedicine	Virtual domestic assistant
ROBOT PRIMER	People affected by Alzheimer's disease care	Support	Wearable robot (clock form), which can display a hologram
AIR-CLEANER	Public service	Air cleaner	Detects noxious substances and measures air quality
TRASH-DIVIDER	Public (municipal) service	Waste disposal	Scans mixed waste and distributes it in relevant watertight boxes
BAR-OBOT	Leisure	Bar service	Barman robot

Resonance

All of these projects were in keeping with existing opinions and attitudes, as well as with public information and scientific knowledge regarding the use of robots for housekeeping, elderly care, and public services.
In this sense, they resonate both with advanced knowledge about these issues (Eurobarometer 2012; Taipale et al. 2015) and with everyday reasoning. For example, HELPOLD's designers say: "once you are at home, Helpold will not seem [to be] just a machine, but [instead, will seem like] a new member of your family.
" In order to reach this goal, it should have the possibility "to insert photos, personal stories, and memories of the elderly, which allows Helpold to become more human and familiar as possible.
" Similarly, for the inventors of ROBOT PRIMER, voice messages are not enough—the advantage of this project is that it "can display a hologram that interacts with the elderly."

Rhetorical force

The projects justify coherence and the effectiveness of the robot design through two different strategies: technocentric and value-centric. All the project team stressed the technological innovativeness of robots, describing in detail all of the features of the robot such as sensors and actuators. The robots designed to be always online and use multiple communication channels (see Table 1). On the other hand, with the only exception of BAROBOT, the persuasive force of these social robots lies in their capacity to respond to lived and concrete problems. Addressing issues related to everyday home duties, elderly care, or environmental protection, these robots are much more "useful" than they are "amazing.
" The intertwining between technical and value-oriented design emerges, for example, in BV ROBOT or in the TRASH-DIVIDER. The BV ROBOT "is built with cutting-edge technology, intended primarily for the elderly, but [is] also very useful for the busiest families.
Its cleaning functions are safe and efficient and save a lot of time." Similarly, according to the designers of TRASH-DIVIDER:

The device has two entrances, where mixed waste is deposited by the consumer and read by a scanner.
The scanner will identify the type of waste and distribute it in the relevant box.
The device has four containers placed inside it: paper, plastic, moist and non-recyclable, all placed in a watertight compartment. Moreover, the scanner is powered by solar energy.

Institutional retention

Institutional retention was less developed in the conception of the projects.
The implementation of robots was left to the family or to local municipalities.

Resolution

The robots were very high in resolution. In all of the projects, the interface with humans was well-detailed, which shows that they were created for constant interaction with humans.
DOGSISTANT, according to its designers, "has a tabletop that can be used [for] carrying objects, or as a mobile chair for people or as a footrest when a person is sitting in a chair and wants to stretch his/her legs. " DOC-CHAIR was imagined to provide daily advice for increasing wellbeing and sending data to the local doctor. BLIBOT, according to its designer, would "write, read, cook and help with the housework." HELPOLD would also accompany the elderly for short walks or help them get up if they were to fall.

Discussion and conclusion

The essays and project work of participants show conceptualizations of social robots that reflect the current state of the field. For example, the participants were fascinated by the new possibilities that robotics opens up in the field of music, but they are also aware of its limitations (cf. also Cossettini 2013; Manning 2004).
In both the studies, students' conceptualizations of social robots show all of the five dimensions identified by Schudson: retrievability, rhetorical force, resonance, institutional retention, and resolution. However, according to some students, the social robot lacks features such as creativity, emotions, authenticity, and talent that are considered inherently human. Furthermore, robots are not able to participate in the social rituals that accompany music consumption and foster emotional bonding with audiences and fans.

This debate about musician robots was presented by students from the perspective of "them or us," that is, using the substitutive approach.
This is a very widespread perspective that evidently also continues to persist among students. On the one hand, robots are often seen as competitors of humans, and their limitations are exaggerated in order to demonstrate that they are much less than humans (this is a reassuring strategy that aims to convince people that they are the undisputed protagonists of the society). On the other hand, robot's virtues are exaggerated.
This perspective, which is also widespread among scholars of the robotics community, is similar to Aristotle's fascination with ancient robots— thaumata.

The automatic wonders surprise the audience and show humans the excellence of their own genius (Lanza 1989). We argue that in order to be prepared for the coming critical phase, there is a need to overcome both of these perspectives and start thinking of "them and us"—look toward a society that includes robots in everyday practices (cf. also Dautenhahn and Billard 1999). Indeed, when students are asked to operationalize their conceptions of social robot by producing a concrete prototype, they anchor their designs in everyday experiences and needs.
This obliges them to radically rebalance across the five dimensions of the cultural object. The retrievability is weak here, as the projects are very targeted. The rhetorical force comes from the social robot's capability to assist in lived problems. The resonance is now limited to the rules and the ethos of the university.
The institutional retention is here limited by the horizon of the household, and at most, of the healthcare system. The resolution is very high, as social robots are expressively designed to provide help and support in everyday domestic life. The rebalancing across the classical five dimensions called for by the peculiarity of the social robot as a cultural object suggests that there is a need to add another dimension to Schudson's framework.

This dimension can be properly understood if we are able to produce another reading of the robot as a cultural object, no longer bound only to its consumption.

In the area of consumption, its irreducible difference from other cultural objects ends in dilution. While the cultural objects are usually inert, the robot enhances the fundamental properties of the technology, which is the capacity of producing movement and actions.
The capacity to move and act autonomously gives actual agency to the robot and creates specific tensions in the relationships with humans.
These tensions have two sources. One is a "frictions of power" between humans and robots since both may be perceived as moral agents (Gray, Gray, and Wegner 2007).
The second is the fact that today the robot immediately enters into the realm of produsage (Bruns 2008)—the mix of production and consumption that engenders potentially charged interaction between users and the powers that be and their robots.

That said, these five dimensions seem to be necessary, but not sufficient to delineate the entire nature of this technological object. The peculiar affordances of the robot suggest the need for the further development of the theory with which we started.
While Schudson's theory is effective for the consumption of cultural objects, it does not fully address the peculiarities of the social robot as a cultural object.
Different from the other cultural objects, the social robot does not simply exert influence on the users, but it also gets intertwined with everyday life, producing material changes.
Indeed, robots are technological artifacts, which not only produce changes in the field of the consumption of culture but also in the field of its production, as well as in the production of new cultural objects, quite autonomously. This is the reason that we need to introduce a sixth dimension that we call dynamicity—the capacity for directly producing change in the production and reproduction processes.

This is a preliminary proposal that needs to be further explored in order to overcome the limits of the two exploratory studies we presented—above all, the lack of generalizability of results and, second, the peculiarity of the population that participated in the studies.
The students were enrolled in science and technology courses and were therefore a special population with perhaps more positive view of robots. Future research needs to explore more profoundly the youths' conceptions, attitudes and everyday practices related to robots using other methodologies—observational, as well as quantitative— in addition to the use of other theoretical approaches (Frennert and Ostlund 2104).

Notes

1. See, for example, the work done by the Robotics School of Genova, http://www.scuoladirobotica.it/

2. See, for example, InMoov, the project initiated by Gael Langevin, a French model maker and sculptor in 2012, http://www.inmoov.fr/

3. The essays were graded on originality and strength of ideas expressed.

4. I-methodology is "a design practice in which designers consider themselves as representative of the users" and use their own personal experience to inform design (Oudshoorn, Rommes, and Stienstra 2004, 41).
Of course participatory design is supposed to modulate this tendency.

5. https://www.youtube.com/watch?vDMAbKXp7CP0g

6. https://www.youtube.com/watch?vDkpZqBM06sdM

7. http://www.lithias.fr/sculpture-numerique.html

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