Future Visions for a Decolonized Future of Human-Computer Interaction:

Thick descriptions of a survey created to discuss the colonization of imagination..[1] [2]

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A forecast of a high-tech society often represents the visions of industry. The possible technological developments and innovations presented by tech companies promise a bright future, supposedly offering all a better quality of life. However, the ideas give protagonism of a particular style of life and reveal privileges that do not match the environmental and socio-economic tensions from the global south. We propose a discussion for the ‘special interest group’ to analyze historical visions of the future commonly presented by companies. We started a 'proof of concept among us with an internet questionnaire and a form to allow participants to be proactive in proposing alternate visions by sending images. From this experience, we offer a thick description of the perspectives and feelings related to the questions submitted. This ethnography is

1 Article sent to the SIG (Special Interest Groups) of CHI2023 to promote the discussion about the decolonization of data within computer systems within the community of researchers.

2 This paper is a partial result of an experiment conducted by Dr. Elen Nas with colleagues of a research group in human-algorithm interaction as a groundwork to increase the discussions on decolonized futures of AI.

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a ground for future work where we aim to investigate how HCI literacy and knowledge of cultural studies impact the identification of biased content. Also, collecting data through questionnaires and forms can help participants increase awareness of image content on the internet and motivate them to present their voices proactively. For further actions, we aim to develop a platform able to provide quantitative data with diverse aesthetics for future visions, capable of adding diversity to the digital ecosystem.

CCS CONCEPTS • Social and Professional Topics → User characteristics → cultural characteristics • Human centered computing → collaborative and social computing → Empirical studies in collaborative and social computing • General and reference → Cross-computing tools and techniques → Experimentation

Additional Keywords and Phrases: SIG, HCI, cultural diversity, inclusion, decolonization, global south

1 INTRODUCTION

The session proposal for the Special Interest Group (SIG) represents the beginning of a task force to decolonize the future of HCI. We are Brazilian researchers from diverse backgrounds. Our group comprises white, black, urban citizens of indigenous origins from different age groups. To organize the preliminary information contained in this paper, we started a model to work within a focus group format. We are researching various human-algorithm interactions at the Institute for Advanced Studies of the University of São Paulo. Elen is a Social Scientist in which the production comprises the connections between Bioethics, Arts, and Design; Fernando is an Architect studying the use of AI to imagine future cities; Luciana is a UX Designer interested in inclusive HCI; Telma is a Psychologist that investigates art expressivity at digital platforms, and Tania is a Psychiatrist and Professor of the Federal University of Rio State interested in the connections between HCI and mental health.

As we are starting a pilot platform called DecolonizAI [1] to collect data ethically, which also opens the possibility of creating a database that includes cultural diversities, the first discussion created through a quiz is about imagining the future of things.

From the interaction with a set of questions illustrated with future visions from the past [2] and a form where the participants could send their proposed images of the future, we start the discussion here with the 'thick descriptions of each participant. This ethnography is the groundwork to amplify the conversation with the SIG. For the group session, we will summarize the questions and translate them into English to offer the international group the elements to add and review our previous discussions.

With the SIG, we aim to foreview, comprehend and evaluate the possibility of having general patterns in HCI that can contribute to cultural diversity, inclusion, and ethical awareness.

1.1 Thick description#1: Elen Nas

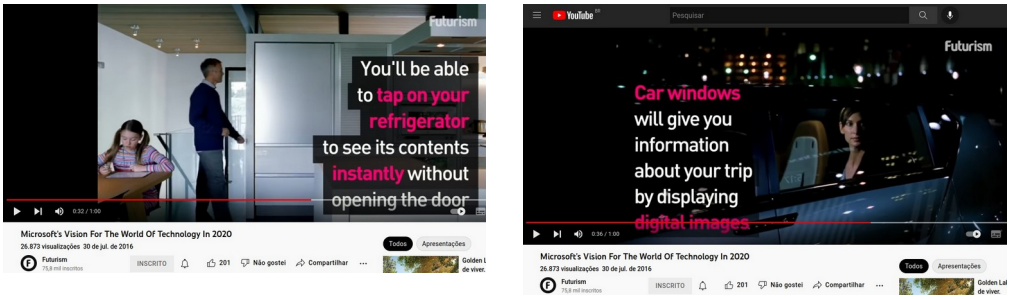

Figure 1a, b: Still frames from the Microsoft visions for 2020. [3]

In 2015 when I was doing my Master in Design at the Pontifical Catholic University in Rio de Janeiro (PUC-Rio), I had the opportunity to teach a Design and Emerging Technologies class. As my research topic was about the innovations brought up with Electronic Art, such future visions excite the imagination. I selected some images and videos to show the students as "Cool Town HP"[4], IBM RFID [5], Microsoft Future Vision 2020 [6], Siemens [7] and Virgin Media [8], among others. I expected that this selected group studying Design, mostly from wealthy families, would like and approve of those visions for the future. Fortunately, the Design at PUC-Rio is well-connected with the Social and Environmental Design discussions, and some students criticized the future visions for 2020, calling them 'pretentious.'

And I then realized the importance of contextualizing ideas and ideals, as the visions of the future from tech companies were connected to notions of the global north and from countries that don't know the realities of big cities like Rio de Janeiro and São Paulo.

Seven years later, after an extensive list of HCI, AI, robotics, and ethics research agendas, I see that classifications and ontologies require a detailed description of contexts to allow inclusive designs within the human-algorithm interaction.

I created the quiz [2], knowing it was for a group of informed people. Still, because of the excessive specialization of research topics, I thought they might not know the information provided in the questionnaire.

Thus, the first objective of the illustrated questions was to provoke reflections about the cultural perspectives that might be over-represented in the digital content, resulting in the colonization of imagination.

The second step was to ask participants to send a self-ethnography about the interaction process with the prepared content on the web.

From this process, the participants provided thick descriptions reporting difficulties, frustrations, joy, or excitement when searching/preparing the images to send.

The' Discussion' will explore these results further in topic two.

1.2 Thick description#2: Fernando Longhi

Figure 2 a, b. Images produced with Dall-e 2. 2a shows the answer for the "future of cities" while 2b shows the answer for the "future of housing". Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

As an Architect, I have always thought more about spaces than people – whether it is a remnant habit of Modern Architecture School curricula or a personal search for more qualified areas. I believe that the two future visions (Figures 2a,b) I have created with Dall-e 2 [9] to answer the Quiz [2] can best illustrate my journey through the profession and individual beliefs. Since I started designing spaces in the real world, transitioning plans and section drawings into actual walls and roofs, I became increasingly aware of how influential the built environment can be to people's perception, emotions, and experience of spaces. In Kevin Lynch's "The Image of the City" [10], in 1960, the American urban theorist gives us a taste of how different urban structures and elements can create a set of mental images that impact and constitute these social spaces. Today, I question if the images we are constantly consuming through multiple screens (from tablets, smartphones,s and so on) can also play an essential part in these social spaces, including the imaginaries we create and collect.

When tasked to think about an image for the future of the city (Figure 2a), I found myself divided by two mental scenarios: a positive one and a negative one. The first one carried a desire for a progressive, inclusive, and environmentally aware condition. A bright future for the city and its citizens. The second scenario accounted the countless difficulties our society go through in the urban realm. Social segregation, housing crisis, climate change, wars, etc. The first image that came to my mind in this negative scenario was a post-apocalyptical cyberpunk city. After quickly assessing these two possibilities, I decided to go for what I *wanted* it to be like. This was possibly my architectural mind going into action, trying to idealize a more positive future for humanity.

Rather than searching for predetermined images on the Web that would relate to this imaginary, I took Dall-e 2, an AI system able to create images from descriptions in natural language, as a tool to best illustrate my thoughts and designs. After several attempts, going from conventional smart city models to sci-fi-related images (all including agitated holographic environments, driverless cars, and colorful sunsets), I have chosen the one that best translated my desire for an idealistic future city. Dealing with mental images and written descriptions were not easy. I had to go from simple to complex explanations to achieve better outcomes. The chosen image (Figure 2a) shows us a utopian approach that I later associated with Ebenezer Howard's modernized Garden City [11] mixed with the Stanford Torus, NASA, 1975. The resulting city was good-looking, with greens, organized elements, and an impacting perspective pointing toward a sacred-like light. Nevertheless, this surgical urbanism may be a naïve and hygienist angle of the future, even lacking humanity, if I dare say. It may be a question of scale, but this monumental uninhabited city image triggered discomfort and made me question once again my own reality.

Accordingly, I have adopted a more critical and skeptical approach to envisioning the future of housing (Figure 2b). Considering the current housing crisis, technology issues, and extreme social stratification in Latin America, I imagined a family in a vulnerable environment where all interactions were performed virtually. The built environment was just a ruined shelter with no regard whatsoever. This neglected materiality needed to be forgotten. I was both surprised, satisfied (I had accurately achieved the image I envisioned), and concerned about the resulting image. Dall-e was able to solidify a powerful and critical image of our contemporary condition, touching multiple aspects I am personally concerned with. That future of housing image exposes the ugly side of our social structures and systems and how technology and its use can play for and against us.

This survey interaction felt like a conversation. For the first part, its various images allied with clear-cut questions provoked me to deeply reflect on the shown aspects, even though I felt some of them had an obvious point of view (like misogynistic ads) that leaned me to take a more critical approach in my answers. For the second part, dealing with Dall-e 2 was challenging, yet a fruitful intersubjective dialogue with an AI system. I was influenced by the set of images Dall-e asked me to choose and how the system was programmed. This aspect reminded me of Vilém Flusser's "programmed freedom" [12], is there freedom and free will in a programmed world?

1.3 Thick description#3: Luciana Terceiro


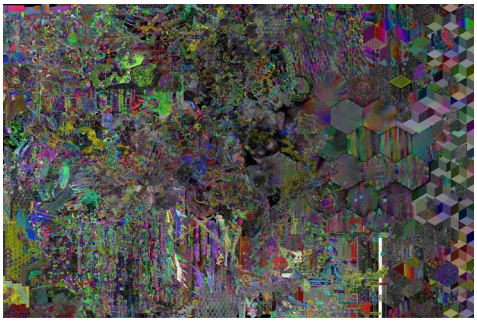

Figure 3 a, b [13, 14]. Images that describe future urban spaces and art

When I received the invite to answer the questions regarding future visions [2], the first thought that came into my mind was all the science fiction movies I have seen and their inaccurate forecasts. The explanations for these inaccuracies may be various, and cognitive biases might be one of them. As Loewenstein and Angner [15] point out, the projection bias may be one of the factors responsible for projecting the present into the future, leading humans to imagine a tomorrow limited by today's knowledge. My second thought was that I would probably step into the same misconceptions and biases. Nevertheless, I decided to board into the imaginative exercise and take my chances on creating my visions of the future.

When I started answering the questionnaire, I confess that the chosen videos and pictures in the questions amused me. The past perspectives of the future presented an optimistic view of the tomorrow, even if the imagery was primarily created within white Western, Global North references. Some could affirm that it was also part of this future that I desired. The videos produced by large tech corporations showed cheerful families enjoying the best life that emerging technologies could offer. Who would not love that?

The questions encouraged me to look for images to illustrate my envisioned future. Guided by the survey, I started thinking about my future visions for education, communication, food, tools, urban spaces, health, transport, retail, arts, and living. Some were easier to imagine, presumably due to my own desires. Other images were much more complex to visualize, as the number of possibilities was countless. My primary tool to look for images was Google Images, and I used several keyword combinations to describe what I envisioned as future environments. It is necessary to point out that despite my native language being Portuguese, I was performing the research using English keywords. And despite being a Brazilian citizen, I am located in Sweden. I know that geographical location and language affect search results, and the exact search in other locations and languages might show different results. However, I hadn't had time to explore different setups.

Some topics as cities (Figure 3a), transportation, and living, had a red thread in common. For those, I expressed a desire for environments in balance with nature. A future that, notwithstanding the technical advances, could provide a green, ecological space for humanity. But I was aware of the challenges of these visions. While these verdant and, at the same time,

high-tech settings were not so farfetched for countries like the Scandinavian ones, they were pure science fiction for other realities. However, all these distant realities coexist on the same planet. Furthermore, there is no possible future in a world where some thrive while others merely survive.

For education (A2b), my keywords expressed wishes to encourage the learning of collaboration more than the technology itself. Technology in this area may be a powerful tool to facilitate access to information and promote knowledge. Still, without the experience of diversity and inclusion, it will not lead to significant and democratic changes. When reflecting on food (A4b) and retail (A6b), environmental concerns were once again the main factor that came into my mind. My keywords reflected the production optimization to provide goods with as little ecological harm as possible.

The last topic I searched was Art. It was the last one because it was the hardest for me. While in the previous ones, I had some keywords in mind, for Art, I had none. Reflecting that Art grasps and holds technologies and resources according to its needs, instead of being dominated by one technique or another, I looked for images that do not represent any specific scenario but have the potential for various interpretations (Figure 3b). Art, like future, is still open to many possibilities.

1.4 Thick description#4: Telma Azevedo

Figure 4 a, b. “Marina Bay Sands”, Singapure. (a) “The Matrix” (1999) movie frame. (b)

My imagination about the future corresponds to identifying contrasts between the global north and south. The north, to my perception, represents too many generic buildings, with transitory or passing ambiance, with sumptuous volumes loaded in chrome, glass, or fiberglass and very cold - to the molds of the cities-scenery as Las Vegas - with artificial plants that do not dirty and are efficient in mimicking an instagrammable well-being. In these places, resources and technology are concentrated, and everyone complies with the standards accepted there, acting so that the accumulation intensifies [16]. The south not only refers to the southern region of the consensual political representation of the globe but to the diverse souths that exist and are the counterpoint to the accumulation of the global north. In these places, aridity by the subtraction of natural resources and the lack of basic sanitation and dignified subsistence, precariousness, and attempts to erase its importance only find loopholes when cultural

expression and creativity are co-opted to give an air of relevance and personal sense to the increasingly fetishized goods of the global north. This model served as a theme or atmosphere so that the images that referred to a future focused on the primacy of technology were recorded, as well as the precariousness of the subjugation of many others in a contrast of color, texture, and the subjective relationship between the members. However, something in the future eludes us, just as smartphones escape us. Perhaps more pandemics will give vent to the unemployed contingent that the hegemonic companies linked to government public institutions would like to annihilate.

My images of the future are also metaphorical due to the lack of correspondence with the existing material. Often specific scenarios have become a shared future, such as the education of the future is an existing space of a first-world country in a constructivist school with elements of Waldorphian pedagogy, for example. That is, this school exists somewhere on the globe.

I answered the questionnaire in São Paulo, a central neighborhood, Consolação, where the amount of people on the streets and socially vulnerable grows by the window of my apartment. I live in front of a restaurant with progressive leanings in which people try to impose some power through their clothing and body adornments. As I look out the window, I see myself, and I don't see myself in the giddiness of an echo. There are many delivery men with their motorcycles stopped, which gives me the perspective of effective social transformation mediated by technology. This change has sound, color, substance, and feeling.

Along the lines of Rolnik [17], thinking, these visible and not so obvious environments that cover cities, and more intimately the environments, carry textures and ontologies that permeate meanings and modes of existence. This aesthetic mark formed by images that interposes as a filter between the world and the eyes, makes us "blind to the tense pulsation of reality" since these intense images from the spectacular point of view, however redundant, "condition subjectivities to advertising values".

1.5 Thick description#5: Tania Valente

Figure: 5a shows “Blade Runner movie vision” and 5b shows “Elysium movie vision” in a collapsed world. Searched December 5rd, 2022, by Tania Valente with Google Images.

Imagining the future is always complicated, even more so for someone like me who was born in the 1950s and has lived in a changing world. Artificial Intelligence and its developments brought (and will bring) very significant changes to human beings regarding health, food, transport, communication, education, and commerce, among other fields. The questionnaire clearly shows how today's world was unimaginable for my ancestors (my grandmother was born in 1900!). I have read science fiction since I was a teenager, but the world I imagined for the future will be different than the one my grandchildren and great-grandchildren will live in.

This brought me two types of feelings: the first one is the sadness of not being able to live this imagined future because I won't last forever. The second is the concern about where this might lead us. I fear humanity will lose its psychic and emotional reference when dealing with technology since I belong to a time when the face-to-face relationship was the reference.

On the one hand, the questionnaire brought some elements that present a much easier life with the presence of AI: autonomous cars, ultra-fast communication, less time wasted on household tasks with the "smart home," changes in commercial relationships, and access to information, among others. But I can't stop thinking that this will not be distributed equally. It would be a utopia to think this way. Humanity may be divided between those who will have easy access to that and those who will be very far from these privileges, perpetuating the existing inequality or the domination of one part of society by another. Take, for example, the image that reflected the art of the future. Google presented me with futuristic photos, but none represented what I would like to find, representing an art that was more interactive and decolonized since that is what I expect from the future. I didn't find anything to suggest that.

The images I chose to insert in the answers (A2d, A3d, A4d, A5d, A6d, A7d, A8d, A9d, A10d, A11d) present a predominantly pessimistic vision of the future. The photos that caught my attention among those offered by Google Images reflect this because, in a few, there are humans, and the world appears uninhabited or, in a way, sad. Honestly, I hope I'm wrong. Meanwhile, I'm trying to learn to live in this world where every day, there's something new for me to know.

2 DISCUSSION

Figure 6 a, b. Answers for the "future of art" (6a) and "future of transport" (6b) were sent to our Google Forms by an anonymous participant.

A performative aspect of shaping the future through ideas expressed in pictures and films shows that 'envisioning a future' is like preparing public opinion to embrace an agenda of a

technological future in which the industry is willing to invest. Yet, representing specific types of futures in particular ways [18] has politics embedded.

The survey about future visions for the quiz [2] showed that most images illustrate that the target public of those products are middle to upper-class whites, mainly citizens of the Global North (including the British in Oceania).

Although propaganda started to be ethnically inclusive, as shown in the future forecast produced in videos from this millennium, the ones at the top of the chain of technological advancements are white, resulting in visions that perpetuate the colonization mindset.

Thus, as the Quiz [2] shows images from the beginning of the twenty century and other moments of 'futurist waves' such as the 60s, 80s, 90s, and finally, the beginning of the twenty-first century, it reflects that the promised technological advancements claim a better future to all, when in reality 'all' are some. For instance, when Fernando Longhi searches for humans to illustrate his pictures with Dall-e, they are all white, often blond. To show people from different ethnicity, it is necessary to specify, which means the default for human is white. When we discuss data, this logic continues to other contexts where a 'cultural supremacy' occurs in practice by the repetition of the invisibility of otherness.

Including people of color in the new films does not change the fact that they represent populations excluded from enjoying many technological facilities. It creates tensions, confusion, and identity conflicts as the imagination is being colonized by ideals of the future that are exclusive and not inclusive.

When participants looked for content to present their vision of the future with a Google search or an AI, the results represented the hegemonic aesthetics present in future images. It indirectly created obstructions in their imagination to think about a decolonized future that would dialogue with our culture, social, economic, and environmental conditions.

All participants saw the art of the future mediated by high technology, and what about the creativity of people who play, sing, and dance in the streets as ludic interventions? What about the invention of transforming tech debris of planned obsolescence into solutions, sculptures, or accessories like the ones made by Kenyan artist Cyrus Kabiru? The hypothesis to justify a lack of diversity when thinking of the future is that to think about the future is to think about how far technology can go with extraordinary solutions. Nevertheless, if humanity has a future, it will be by valuing the traits where humans can be extraordinary.

The future mediated by 'high' technologies seem effortless to only a few, and we shall ask how the patterns expressed in the images influence everyone to pursue the same goal. Moreover, it can be stressful to see that ideas for the future are not dialoguing with the reality in your neighborhood, city, or country. Reflecting on the place the ancestors were when those images were created might reveal the place one is now. Because often, we assume that society is homogeneous in culture and all is possible equally to everyone. And although this universalized idea has been extensively criticized by cultural studies and educational, legal, and ethical perspectives, it is still pervasive, invisible, and highly influential because the aesthetic domain reinforces it continuously.

If "we are asked to imagine using these technologies in particular material contexts." [18] within a politics of anticipation, our proposal here is to investigate all the implicit biases we might have due to this cultural construction and how we can deconstruct it. How should we interact with devices, the web, and apps in a way that can present a narrative that can differ from a forced monoculture? How can we envision a future considering creative and social technology, and how can this perspective gain scale in data infrastructures?

The first challenge is to understand if the first five participants of this experiment had an implicit bias when choosing images where the future could be a paradise for a few with high technological devices and facilities instead of maybe thinking that a world full of people can still be fabulous. Or, if by dialoguing with the content provided by the web and AI, an implicit creative blockage automatically erases other ideas. The fact is that the data available on the internet and which fed machine and deep learning reinforce that the future is related to spectacular technological advancements or, if not, it is a dystopia where human lives with destruction. In paradise or purgatory, the protagonists are few. Therefore, the idea of a community acting together is rarely present in those images.

3 CONCLUSIONS AND FUTURE RESEARCH

Figure 7 a, b. Answers for the "future of communication" (7a) and "future of trade" (7b) were sent to our Google Forms by an anonymous participant.

As the first step of experimentation, the quiz [2] with the combination of inputs, from images to ideas, resulted in a dense experience, individually and collectively, among us.

Individually it made each one navigate into memories, family histories, facing traditions, implicit biases, and educational and cultural conditioning.

Collectively we flowed the process of inputs and outputs with the learning and insights from others' experiences on producing and looking for images to represent their ideas for the future.

To compose this piece, we used a multilayer platform (Slack) that provided an experience that is also inspiring to think about how we can imagine technological solutions to communicate, create, produce and share content creatively and interactively. As the human-computer interaction within such platforms influences memory, cognitive development, or cognitive

blockages, for our multidisciplinary group in Brazil, from different areas o knowledge and ages, it was a new experience that made this process of writing together unique.

We aim to share this experience with SIG and catalyze insights for all of us within an open dialogue that will empower further steps for a decolonized HCI.

Suppose we try to answer what a decolonized HCI would look like. In that case, several questions pop up. For instance, if imagining the future repeats patterns of signification that are not inclusive, how it appears in the semantic web, and which kind of ontologies are created by those meanings?

We aim to conduct this discussion further with more qualitative research until it touches the infrastructures, where quantitative data is transformed into computable knowledge. The cultural aspects of monoculture by colonization dissipate and become trends, beauty, and shared visions. Technical discussions involving ontologies in HCI [19] and the semantic web [20] should consider multiculturalism to find better solutions for our interactions with algorithms, APPs, software, and devices.

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A APPENDICES

A.1 Quiz (selected questions)

1 Scientific discoveries in the modern Western world provoked anticipatory politics about technologies. The image from a German chocolate brand campaign of 1900 speculates that in the year 2000, it would be possible to watch the same scenes from different locations (A1a). Can you imagine where your ancestors were at this time?

2 How do you feel thinking in which place of history were your ancestors?

Figure A1a, Source: https://www.thiscityknows.com/futuristic-postcards-from-1900-germany-in-the-year-2000/

3 The scene below belongs to a film produced by General Motors in 1956 announcing the possibility of autonomous vehicles (AV). From now on, how do you see a research agenda to make this vision a reality attend all of society?

Figure A1b, Source: https://youtu.be/F2iRDYnzwtk

4 In 1961 AT&T sponsored films to foresee the possible uses of remote communication. For instance, the image below shows a woman accessing images of products and making orders by phone using a credit card. Do you think your grandparents and grand grandparents were looking forward to this imagined future and felt they were included in this history?

Figure A1c, Source: https://youtu.be/avHo0-qU8xo

5 In 1967 Philco-Ford sponsored a film called "House of the Future." One of the aspects was to think that part of children's education would happen inside the house with the support of a home theatre and personal computers. Does this scenario represent technological advancements in education, in general?

Figure A1d, Source: https://youtu.be/TAELQX7EvPo

6 In the 90s, as many ideas of the future became concrete, the AT&T film shows a boy using goggles for augmented reality (AR) to simultaneously play a game with friends, receive a call and execute homework, among other possibilities, where the content of the messages transform into fictional content. Based on the questions we are discussing regarding the colonization of imagination, accessibility, and inclusion, provide a commentary.

Figure A1e, Source: https://youtu.be/yFWCoeZjx8A

7 Step two: please select images to illustrate your ideas for the future of education, communication, food, tools, city, health, transport, trade, arts, and housing. You can search for them on the web, use an AI to create them, or make drawings. Thanks for answering the questions. By participating, you agree that the information you provide will be part of our research. In case you want to be credited for your images, also if you would like to collaborate for further steps, please provide a way to contact you by sending a message to elennas@usp.br .

8 In addition, if you inform, anonymously, your age range, education, gender, ethnicity, the place you were born, and the place you live now, it will also help us to analyze the results. Thank you.

A.2 Quiz Answers: Future of Education

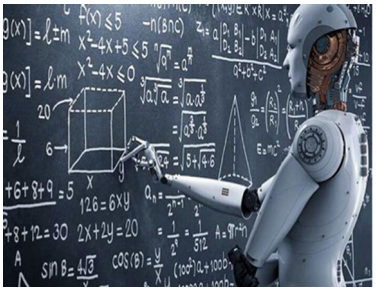


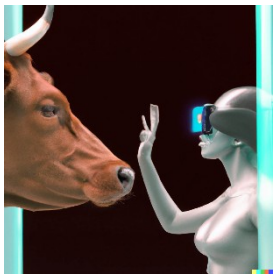
Figure A2a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A2b. Source: https://www.shutterstock.com/image-photo/full-shot-female-teacher-using-planet-1501363457. Retrieved by Luciana Terceiro on December 13, 2022

Figure A2c. Source: https://www.stuff.co.nz/waikato-times/news/8997865/School-happy-for-children-to-learn-the-no-tech-way. Retrieved by Telma Azevedo on December 12, 2022.

Figure A2d. Source: https://republicadoamanha.org/ultimo-encontro-debate-sobre-o-futuro-da-educacao-e-a-educacao-do-futuro-repensando-os-modelos-educacionais/ Retrieved by Tania Valente, December 2022.

A.3 Quiz Answers: Future of Communication



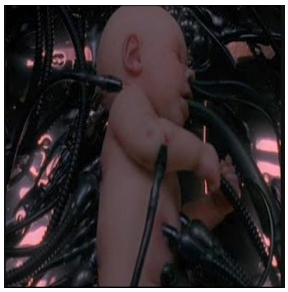


Figure A3a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A3b. Source: https://www.dezeen.com/2019/05/16/barbican-ai-more-than-human-exhibition. Retrieved by Luciana Terceiro on December 13, 2022

Figure A3c. Source: "The Matrix" (1999) movie frame. https://www.thinkzon.com/share_homework/647133.. Retrieved by Telma Azevedo on December 13, 2022.

Figure A3d. Source: https://www.meioemensagem.com.br/marketing/evento-da-kpmg-analisa-o-futuro-da-midia Retrieved by Tania Valente, December 2022.

A.4 Quiz Answers: Future of Food

Figure A4a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A4b. Source: https://www.bonappetit.com/entertaining-style/trends-news/article/food-cubes-art. Retrieved by Luciana Terceiro on December 13, 2022

Figure A4c. https://www.kidzsearch.com/kidztube/future-food-menu-of-2050_98457020e.html. Retrieved by Telma Azevedo on December 13, 2022.

Figure A4d. Source: https://incrivel.club/admiracao-curiosidades/surpreenda-se-com-10-futuros-alimentos-de-alta-tecnologia-455210/ Retrieved by Tania Valente on December 2022.

A.5 Quiz Answers: Future of the City

Figure A5a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A5b. Source: https://theconversation.com/future-cities-new-challenges-mean-we-need-to-reimagine-the-look-of-urban-landscapes-151709. Retrieved by Luciana Terceiro on December 13, 2022

Figure A5c. Source: https://br.freepik.com/fotos/relacionamento-comercial. Retrieved by Telma Azevedo on

December 13, 2022

Figure A5d. Source: https://multiplicitylab.northwestern.edu/iw-3-7-21/ Retrieved by Tania Valente on December 2022.

A.6 Quiz Answers: Future of Trade

Figure A6a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A6b. Source: https://www.insider-trends.com/top-40-on-demand-3d-printed-products-in-retail/. Retrieved by Luciana Terceiro on December 13, 2022

Figure A6c. Source https://tecnico.ulisboa.pt/pt/eventos/ciclo-de-webinars-metodos-e-aplicacoes-da-ciencia-de-dados-espaciais/. Retrieved by Telma Azevedo on December 13, 2022.

Figure A6d. Source: https://inforchannel.com.br/2022/03/23/autocom-mostrara-o-melhor-da-tecnologia-para-o-comercio/ Retrieved by Tania Valente, December 2022.

A.7 Quiz Answers: Future of Housing

Figure A7a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A7b. Source: https://edition.cnn.com/style/article/vincent-callebaut-underwater-skyscraper/index.html. Retrieved by Luciana Terceiro on December 13, 2022

Figure A7c. "Marina Bay Sands", Singapure. Source https://www.pxfuel.com/en/desktop-wallpaper-vxrsa. Retrieved by Telma Azevedo on December 13, 2022

Figure A7d. Source: https://www.bbc.com/portuguese/geral-48865896 Retrieved by Tania Valente on December 2022.

A.8 Quiz Answers: Future of Art

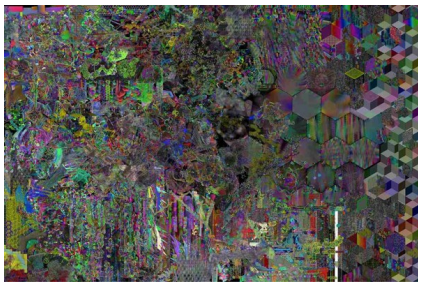


Figure A8a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A8b. Source: https://www.vice.com/en/article/nz4wek/shane-hope-collages. Retrieved by Luciana Terceiro on December 13, 2022

Figure A8c. Source https://prensa.li/@andresaraposo/visite-a-exposicao-imersiva-sobre-van-gogh/. Retrieved

by Telma Azevedo on December 13, 2022.

Figure A8d. Source: https://www.mercadonegro.pe/marketing/conoce-el-modal-un-museo-digital-completo-que-esta-a-la-venta-como-nft/ Retrieved by Tania Valente, December 2022.

A.9 Quiz Answers: Future of Health

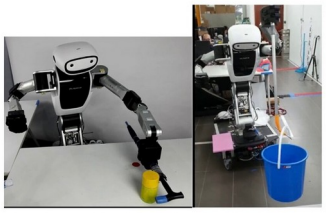
Figure A9a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A9b. Source: https://www2.deloitte.com/au/en/pages/life-sciences-and-healthcare/articles/future-of-health.html. Retrieved by Luciana Terceiro on December 13, 2022

Figure A9c. Source https://markezine.jp/article/detail/32274. Retrieved by Telma Azevedo on December 13, 2022.

Figure A9d. Source: https://www.vydence.com/pt/medicina-do-futuro/ Retrieved by Tania Valente, December 2022.

A.10 Quiz Answers: Future of Tools



The team's robot working with household objects – an umbrella and a wipe-stick.

Figure A10a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A10b. Source: https://techxplore.com/news/2022-07-framework-ability-robots-physical-tools.html. Retrieved by Luciana Terceiro on December 13, 2022

Figure A10c. Source https://digitalpresent.tagesspiegel.de/wie-intelligente-kleidung-unser-leben-verbessern-soll. Retrieved by Telma Azevedo on December 13, 2022.

Figure A10d. Source: https://www.chayaautomacao.com.br/sistema-automacao-industrial Retrieved by Tania Valente December 2022.

A.11 Quiz Answers: Future of Transport

Figure A11a. Produced November 3rd, 2022, by Fernando Longhi with Dall-e 2.

Figure A11b. Source: https://www.groundworks.com/resources/how-does-the-hyperloop-work/. Retrieved by Luciana Terceiro on December 13, 2022

Figure A11c. Source https://www.acterience.com/zurueck-aus-der-zukunft-ideen-fuer-die-mobilitaet-von-morgen/ Retrieved by Telma Azevedo on December 13, 2022.

Figure A11d. Source: https://jetpackaviation.com/jetpacks/ Retrieved by Tania Valente December 2022.