Systematic Review

Does Anyone Care about the Opinion of People on Participating in a "Social" Metaverse? A Review and a Draft Proposal for a Surveying Tool

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Abstract: In recent years, the attention paid to the metaverse in the scientific world has increased; the hottest topics include system architecture and enabling technologies, as well as business, privacy, ethical, and security issues. On the other side, at the mainstream level, it is well known that the company Meta (formerly Facebook) is striving to realize its interpretation of a "social" metaverse. As Meta is a big leader of social media, it is reasonable to guess that, in the future, users will participate in a new social platform, such as that which the company is building by depicting unlimited and engaging opportunities. Regardless of Meta, we ask what the opinion of people is about this possible future scenario. A literature search of previous works about this topic has been done; the few results we found were not properly on topic and showed heterogeneous content. A survey on interpretations of the metaverse of major information and communication technologies (ICT) companies that impact the consumer world was undertaken; the results show that Meta is the most prominent company with the mission of building a "social" metaverse worldwide. Finally, a draft of a tool for assessing the predilection of people for a "social" metaverse, based on various facets of the future social platform, is proposed.

Keywords: metaverse; survey; questionnaire; people; opinion; society; future

1. Introduction

There is not a unique definition of a metaverse; a broad informal description could be that it is a whole of many virtual reality worlds where users can engage with a huge variety of activities, can socialize and meet people from around the world, can be represented with customizable avatars, and can benefit from the absence of limitations due do locations and traveling. The first appearance of the term "metaverse" was in 1992 in the dystopic novel *Snow Crash* [1]. At the present time, the metaverse is a system still under construction, but it has been a topic being developed in the scientific literature for many years; the first relevant works can be found in the early 2000s. The authors of [2,3] provide insights into definitions and a history of works.

Several studies have been done on the metaverse, sometimes without mentioning it explicitly, by addressing the requirements, architecture, enabling technologies, usability, user experience, acceptability, and factors related to motivation for the use of VR, privacy issues, legal and ethical issues, the future of society, and other topics. A short summary of such studies is presented below.

Studies have been done about technological aspects of the metaverse. The work presented in [4] is an early deep analysis of the transition from independent virtual worlds to a network of integrated virtual worlds (called "metaverse"). The paper, discussing the current status of technologies and requirements, presents a road map for such a transition that is composed by four key elements: realism, ubiquity, interoperability, and scalability. The research in [5] proposes a framework for supporting a visual construction of the metaverse that is composed of visualizations, graphics, and interaction techniques. A

taxonomy of interaction technologies is presented, as well as two different pipelines for designing scenes in the metaverse. On the other hand, ref. [6] is a large work where a taxonomy of the metaverse has been proposed; that study notes that hardware, software, and contents are the essentials blocks for realizing the metaverse and that user interaction, implementation, and application are the three main approaches which are suitable for it. The paper also describes social influence factors and open challenges such as potential increases in inequities, legal aspects, and devices limitations. The authors of [7] first mention current developments made by some of the big tech companies, e.g., Meta aims to realize the metaverse for social purposes; Apple and Microsoft have applications for connecting users to virtual spaces, aiming to improve productivity; video-gaming and development companies such as NVIDIA and Epic Games have specific frameworks for designing and developing software for building metaverse applications. Then, scalability, accessibility, security/privacy, and legal issues are proposed and analyzed as the main requirements of the metaverse. The paper also mentions the Workrooms platform from Meta and the AltspaceVR platform from Microsoft as prototypes of the metaverse; both are virtual worlds across the internet where people can join, be present, and interact. The authors of [3] presented a systematic review analyzing and cataloguing the topics and components related to the metaverse, as well as connections with the social sciences and neurosciences. That work reported the expansion of relevant works since 2022; moreover, a set of heterogeneous definitions of the metaverse was reported, as well as enabling technologies.

Several works have been done on users and related issues, focusing in particular on questions of privacy, identity, and security. The research in [2] firstly provides a detailed report on the history, definition, and main features of the metaverse. Then, it focuses on an analysis of the metaverse in education and on its requirements and components. A framework based on enabling technologies and on a pipeline for learning is proposed, and all related components are described. The work also touches on the topics of addiction, security, and identity. In [8], a starting point is presented for discussion of the user experience and the social acceptability of immersive VR with players in public places by evoking the themes of playing among other people, safety and privacy. An experiment done on a sample of users of immersive VR who heard sounds from a simulated real social environment surrounding them showed increases in distraction, concerns about privacy, and other variables. The authors of [9] presented a detailed study on the degree of acceptance of the VR experience as a substitute for reality. The results of the experiments suggested that "active" VR experiences are less accepted as a substitution for reality compared to passive ones, in terms of the realization of sensorial, emotive, cognitive, and perceptive feelings. The authors of [10] argued that the rendering of additional senses, more than hearing and vision, is needed to fully realize an immersive VR experience; the work presented the components of an "Internet of Senses", an infrastructure made by all senses and including affective computing, quality of experience, and brain–computer interfaces. The senses are part of the elements eliciting immersion; however, virtual reality is also built on psychological components close to the narrative of virtual scenarios, role playing, and, in general, acting as affordance for immersion, as reported, for example, in [11]. A comprehensive survey addressing security issues, problems, and potential solutions, together with projects for implementing the metaverse, as well as a functional and logic architecture, is presented in [12]. The work presented in [13] is focused on the interpretation of the metaverse by Meta as a platform for a new way of living socially and on available applications. The paper mentions a tremendous increase in popularity on the world wide web of the words "meta" and "metaverse" since the presentation of Meta in October 2021. Then, the work focuses on potential applications of the metaverse to smart cities by also providing a long table of pro and cons. The analysis presented in [14] highlights three main risks of the metaverse, i.e., monitoring, manipulating and monetizing users. A road map for regulating a metaverse, focused on regulatory and non-regulatory solutions, is proposed.

Various studies about the dynamics and behavior of society and of companies can be mentioned. In [15], researchers found that most US media coverage considers the

metaverse of Meta as a "space" for people with buying power; only 11% of coverage offered a critical approach to that interpretation. Research in [16] reports that several works have demonstrated that interactions in the metaverse generate an intense sense of social presence (called, for real situations, "we-mode"), because some of our neurobiological systems, typical of real communities experiences, are activated during the virtual experience. The authors of [17] provide a detailed discussion about the role of power of the big tech companies in the realization of the metaverse in relation to the dynamics of society, of addiction, and of influencing. The work analyzes the features presented by Meta and the speech [18] introducing the company; attention is also paid to the narration technique and to the depiction of the metaverse as a technology that certainly will spread in the future. The work also argues that an expansion of the metaverse could generate an increase in the power of the big tech companies and could exacerbate addiction to mass-media.

On one hand, in recent years, the topic of the metaverse has gained increased attention, both in the scientific literature (for example, ref. [3] reports a rapid increase since 2022) and in the mass media. On the other hand, Facebook in 2021 turned into brand-new company, Meta, with the mission of achieving a "social" metaverse, i.e., virtual worlds based on the internet where people can meet, share, and go "behind the boundaries". At present, the company is already delivering early apps and is spending a huge amount of energy and money on research and in development. As Meta is undoubtedly a leader in the field of social media, it is reasonable to guess that its "social" metaverse has the potential to pervade society, and that people will start acting in new virtual spaces in more immersive, vivid, engaging, and fascinating ways, and for extended periods of time. Regardless of Meta, what is the opinion of society, of people, about frequenting such a "social" metaverse scenario? Given that a radical change in habits with social media could happen in the future, we guess that a tool for assessing the opinion of people could be useful. Thus, in this paper, a draft of a tool for assessing the predilection for a "social" metaverse is proposed. To this end, the present work is structured in three main steps: (i) (Sections 2 and 3) An assessment of the interpretation of the metaverse by some of the most prominent ICT companies (Apple, IBM, Microsoft, Siemens and Meta), as they are the drivers of technology and of applications impacting at mainstream level. This helps to define whether ICT companies, other than Meta, are proposing a "social" metaverse and to collect their views of it; (ii) (Section 4) A literature review searching for previous works on the position of people regarding the "social" metaverse. This helps to outline the features of possible existing surveys on the topic; (iii) (Section 5) A draft design of a tool to survey the predilection of people to use a "social" metaverse, taking into account the outcomes of steps (i) and (ii). Section 6 outlines other considerations and presents our conclusions.

2. The Interpretation of the Metaverse by Major ICT Companies

A survey of web contents of some of the main ICT companies (Apple, IBM, Microsoft, Siemens and Meta) was undertaken in order to identify their interpretation of the metaverse and the related features exhibited to audience and to define possible ideas regarding a "social" metaverse.

Institutional web pages with contents explicitly about the "metaverse" were selected and read, and sentences and key points were collected. Institutional YouTube channels were inspected by looking for videos with a title and/or description about the metaverse; the found videos were watched and the stories told there were transcribed in our written notes.

The features which emerged from statements, verbs, key words, adjectives, and so forth, were analyzed to extract concepts describing and promoting the specific idea of the metaverse. Then, the extracted elements were summarized by means of "tags". While examining the web contents, sometimes the features were not only contained in the text but were also implicit or supported by visuals; therefore, the tags were worded taking into account this matter.

The analyzed URLs are listed in Appendix A; descriptions of the tags are shown in Tables A1–A3.

2.1. The Interpretation of the Metaverse by Apple

The survey of the Apple website [19,20] showed that there are no contents related to the metaverse. A supplementary search of the word "metaverse" in the search bar of the home page produced 10 entries. These entries were about apps for social networking, gaming, on-line dating, avatars, and not-fungible token exchange. In other words, the concept of the "metaverse" is used mainly for marketing purposes. A search for the word "metaverse" on the Apple YouTube channel [20] produced four entries, all of which were off topic.

A summary of the concepts and of the tags related to the interpretation of the metaverse by Apple was not done because not enough contents were available.

2.2. The Interpretation of the Metaverse by IBM

A survey of the website of IBM [21,22] showed that there is little content related to the metaverse. A supplementary search for the word "metaverse" in the search bar of the home page produced around 100 entries. After screening the titles and descriptions, two documents about the metaverse were found [23,24]. A search on the IBM YouTube channel [22] produced two entries, both of them off topic. A metaverse platform, called the IBM Spatial Platform [25], was found but only in IBM Japan; it is a virtual reality platform for collaborating and sharing contents in a business context.

IBM mainly considers the metaverse to be a virtual space with the purpose of doing business. The authors of [26] mentioned that the metaverse is characterized by co-presence, co-operation, and connection, and that it offers opportunities to develop products, customer experiences, and so on. The authors of [23] noted that the metaverse can serve to enhance business and marketing, perform industrial simulations, and so on. The authors of [24] described five topics that companies should explore when using the metaverse in their business.

A summary of the concepts and the tags related to the interpretation of the metaverse by IBM is not provided because not enough contents were found.

2.3. The Interpretation of the Metaverse by Microsoft

A survey of website of Microsoft [27] showed that the word "metaverse" is poorly used and that it does not appear in the home page menu items or in the sitemap. Instead, the concept of the metaverse clearly emerged in relation to Teams [28] and Mesh [29] (the software platforms for holding online meetings and online presence), as stated in [30]. A search of the word "metaverse" on the Microsoft YouTube channel [31] produced around 100 entries; after a screening the titles and the descriptions, five videos about the metaverse were inspected. A search of the word "mesh" on the associated YouTube channel and on the Microsoft Teams YouTube Channel [32] produced, respectively, about 140 and 15 entries. After screening the titles and the descriptions, 11 videos about the metaverse were inspected, for a total of 16 videos.

From an analysis of the contents of the web site and of YouTube channels, some key points about the idea of the metaverse by Microsoft were summarized:

- The metaverse takes shape in three spheres: consumer, commercial, industrial [33];
- It is a digital world where people can meet, interact, and share data (as stated, for example, in [30]);
- It allows people to communicate, meet, share data and experiences, and to improve the quality of relations. Users can enter the metaverse from everywhere and at any time;
- Its characteristics mainly focus on contexts of work, business, or entertainment (gaming). The Teams and Mesh software platforms are the main tools, while the specific word "metaverse" is poorly used.

The Tags MSTi ("MS" stands for "Microsoft"; shown in Table A1) represent the concepts presented by Microsoft while promoting the metaverse (by means of Teams and Mesh). Histograms of plain frequencies of the tags are shown in Figures 1 and 2.

Amount of tags MSTi (on 89 sentences and 2 embedded videos; Microsoft website)
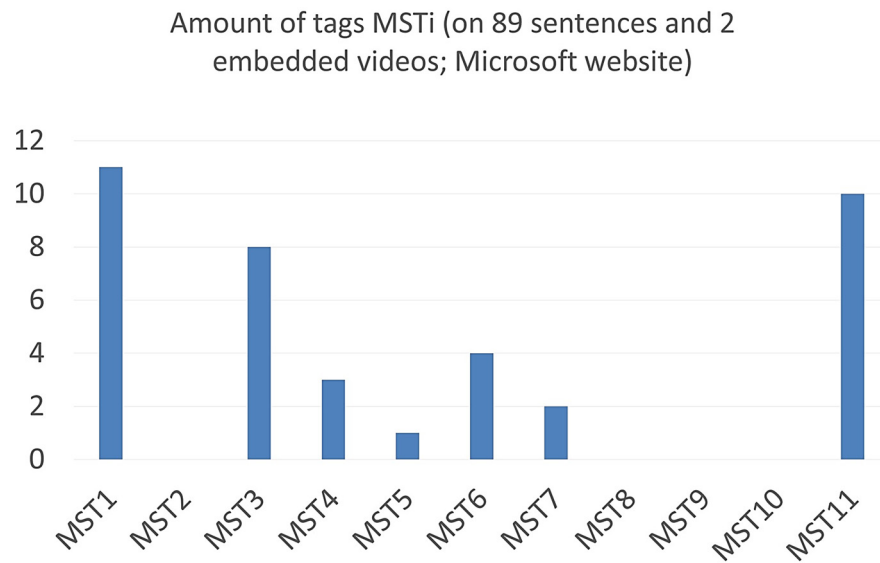
Figure 1. Histogram of the MSTi tags assigned to sentences on Microsoft web site. An inspection was performed on 89 sentences and two videos embedded in the web pages. The full tags are shown in Table A1. The (short) names of the tags are: MST1 = Sharing/working with others; MST2 = Doing activities of daily living; MST3 = Connecting from everywhere/at any time; MST4 = Representing yourself the way you want; MST5 = Representing yourself to express yourself; MST6 = Removing the barriers; MST7 = Freeing up budget; MST8 = New internet; MST9 = It can damage health; MST10 = It works on all devices; MST11 = Improving quality experiences.

Amount of tags MSTi (on 16 videos; Microsoft Youtube channel)
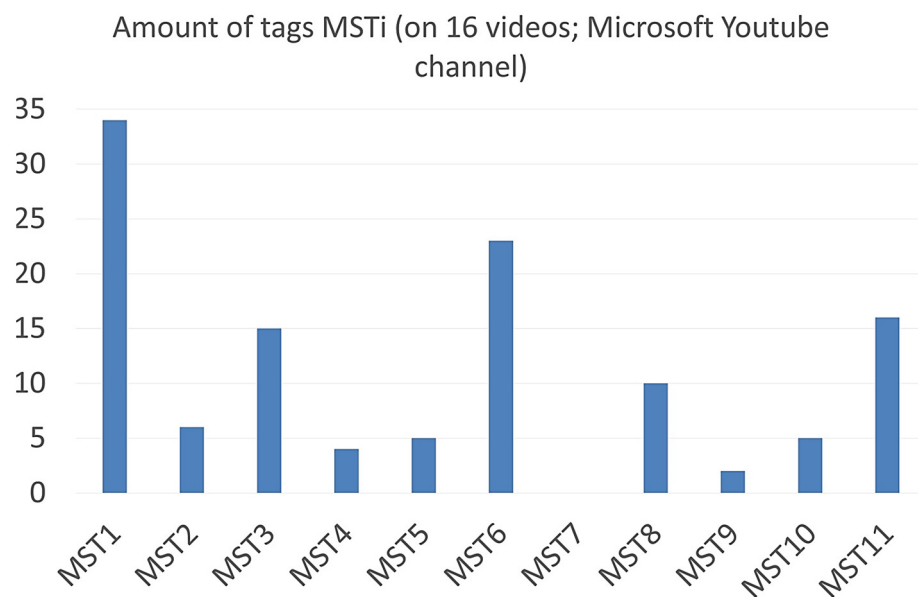
Figure 2. Histogram of MSTi tags assigned to videos watched on the Microsoft YouTube channel. An inspection was undertaken of 16 videos. The full tags are shown in Table A1. The (short) names of tags are: MST1 = Sharing/working with others; MST2 = Doing activities of daily living; MST3 = Connecting from everywhere/at any time; MST4 = Representing yourself the way you want; MST5 = Representing yourself to express yourself; MST6 = Removing the barriers; MST7 = Freeing up budget; MST8 = New internet; MST9 = It can damage health; MST10 = It works on all devices; MST11 = Improving quality experiences.

The histograms of the tags show that the most frequently encountered concepts were "Communicating, sharing, working with others" (MST1), "Connecting from everywhere/at

any time" (MST3) and "Improving quality of actions/experiences" (MST11). The tag "Removing the barriers" (MST6) also had noteworthy frequency in videos (Figure 2).

2.4. The Interpretation of the Metaverse by Siemens

The survey of the Siemens website [34,35] showed that the metaverse is very important for the company. A search of word "metaverse" on the YouTube channel produced 9 entries, all of them about metaverse.
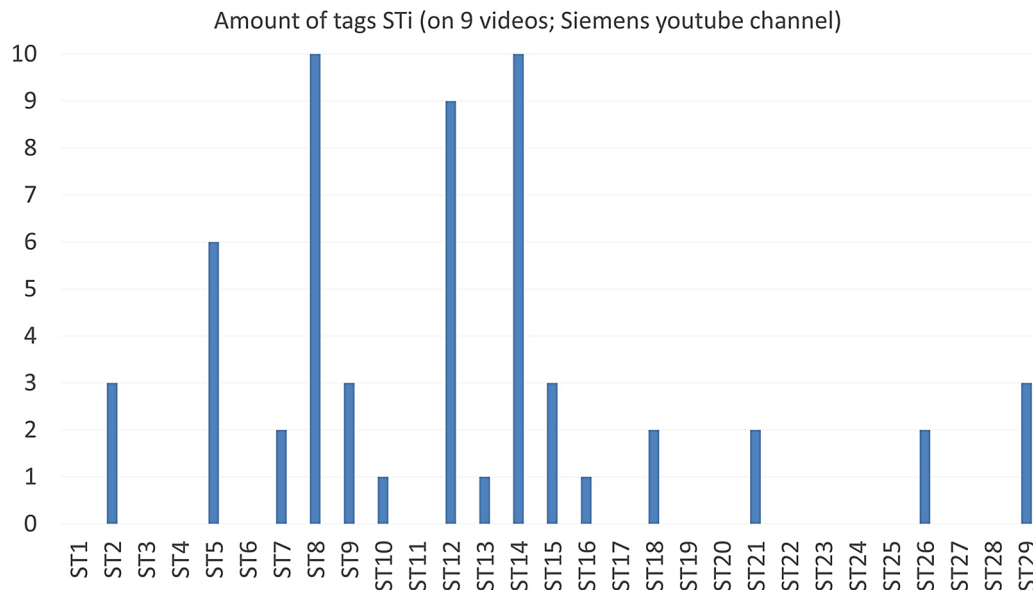
From our analysis of the contents of the web site and YouTube channel, some key points about the idea of the metaverse by Siemens may be summarized as follows:

- The metaverse takes shape in three forms: industrial, enterprise, and consumer (as stated for example in [36]);
- Siemens places itself entirely in the "industrial" metaverse;
- The industrial metaverse is a digital realm representing and simulating the manufacturing/industrial world at all levels; it proposes a new level of industrial automation and a portfolio of software platforms for it. This provides benefits for processes, production, costs, and sustainability;
- It is founded on digital twin (the most important pillar), software-defined automation, data and Artificial Intelligence (AI, especially generative AI);
- It is a real thing, it is already there, it will change the industrial domain.

The STi Tags ("S" stands for "Siemens"; shown in Table A2) represent the concepts touched on by Siemens while promoting the industrial metaverse. Histograms of the frequencies of usage of the tags are shown in Figures 3 and 4.
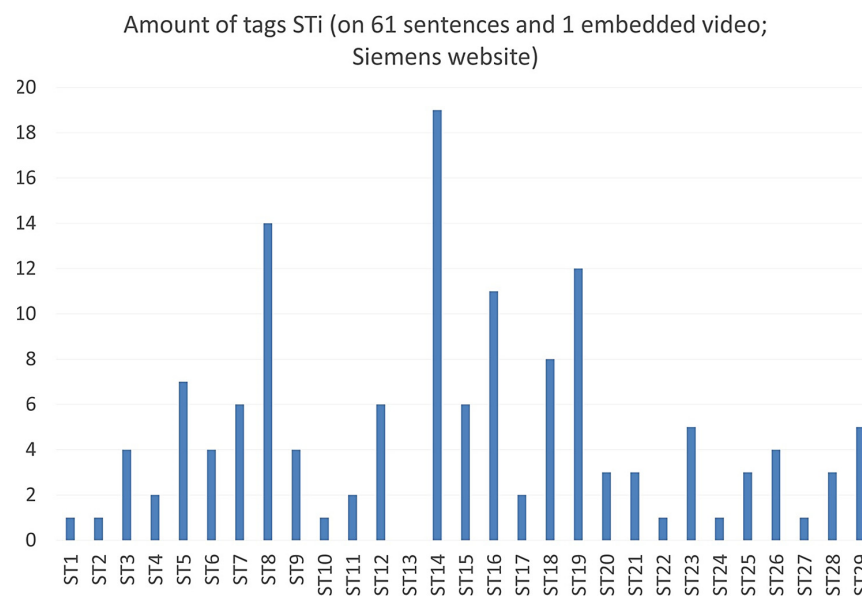
Figure 3. Histogram of the STi tags assigned to sentences on the Siemens web site. An inspection was made of 61 sentences. The full tags are shown in Table A2. The (short) names of tags are: ST1 = Three sectors; ST2 = Digital twin etc.; ST3 = The digital twin is the main pillar; ST4 = Always on; ST5 = Combination of real and digital; ST6 = Connects real to digital to simulate and solve; ST7 = Capability to solve real world problems; ST8 = Simulating/testing the whole thing; ST9 = Simulating/testing at high speed; ST10 = Making decisions; ST11 = Allowing safe environments; ST12 = Allowing sustainability; ST13 = Saving time/money; ST14 = Impacting on real world; ST15 = Realtime collaboration; ST16 = Collaborating/interoperating across systems; ST17 = Avatars for recognizing/interacting/improving; ST18 = Like a real environment; ST19 = New way of collaboration; ST20 = Changing the way organizations operate; ST21 = Getting benefit from skills of people; ST22 = Supporting/motivating people; ST23 = Breaking down distance; ST24 = Saving costs for travelling; ST25 = Need to face the possible fears of workers; ST26 = It changes our lives; ST27 = Doing activities of daily living; ST28 = It will live in the internet 3.0; ST29 = It is real.

Figure 4. Histogram of the STi tags assigned to videos watched on Siemens YouTube channel. An inspection was undertaken of nine videos. The full tags are shown in Table A2. The (short) names of tags are: ST1 = Three sectors; ST2 = Digital twin etc.; ST3 = The digital twin is the main pillar; ST4 = Always on; ST5 = Combination of real and digital; ST6 = Connects real to digital to simulate and solve; ST7 = Capability to solve real world problems; ST8 = Simulating/testing the whole thing; ST9 = Simulating/testing at high speed; ST10 = Making decisions; ST11 = Allowing safe environments; ST12 = Allowing sustainability; ST13 = Saving time/money; ST14 = Impacting on real world; ST15 = Realtime collaboration; ST16 = Collaborating/interoperating across systems; ST17 = Avatars for recognizing/interacting/improving; ST18 = Like a real environment; ST19 = New way of collaboration; ST20 = Changing the way organizations operate; ST21 = Getting benefit from skills of people; ST22 = Supporting/motivating people; ST23 = Breaking down distance; ST24 = Saving costs for travelling; ST25 = Need to face the possible fears of workers; ST26 = It changes our lives; ST27 = Doing activities of daily living; ST28 = It will live in the internet 3.0; ST29 = It is real.

In this case, the inspected contents showed a great abundance of concepts; therefore, many tags were included.

Our histograms of tags show that the most frequently encountered concepts were "Simulating/testing the whole thing" (ST8) and "Improving/impacting the real world" (ST14). From the website contents (Figure 3), the concepts of "Collaborating/interoperating across systems" (ST16) and "New way of interaction/collaboration" (ST19) also emerged, while from the videos (Figure 4), "Combination of real and digital world" (ST5) and "Allowing sustainability" (ST12) also emerged.

2.5. The Interpretation of the Metaverse by Meta

A survey of Meta's website [37,38] showed that the promotion and development of the metaverse are the mission of the company itself. The metaverse is considered as a virtual space for social activities for people around the world. Since Meta's YouTube channel has dozens of videos, all of them about the metaverse, 13 videos were randomly selected and inspected.

From the analysis of the contents of the website and YouTube channel, some key points about the idea of the metaverse by Meta could be summarized:

- The metaverse is depicted as an awesome new virtual space for socializing, where people are free to act without the boundaries of reality (as, for example, stated in [18]);

- It is portrayed as beautiful, as the future of social interactions; it unlocks the opportunity to do what you want; the activities promoted in the metaverse represent activities of everyday life, or an "extension" of them;
- It tears down the barriers of reality and lets the user do anything and be free, better than reality;
- The goals of Meta is to make the "social" metaverse into a new internet and for social media and to gain 1 billion users by 2033 [39];
- Various features and technologies are declared to be currently in their infancy and subject to future development.

Similar topics related to the features of the idea of the metaverse of Meta were mentioned by [17], with those authors observing that they are depicted with a series of very positive and extraordinary attributes and as something with endless possibilities.

The Ti tags (shown in Table A3) represent the concepts touched on by Meta while promoting the "social" metaverse. Histograms of the frequencies of the various tags are shown in Figures 5 and 6.
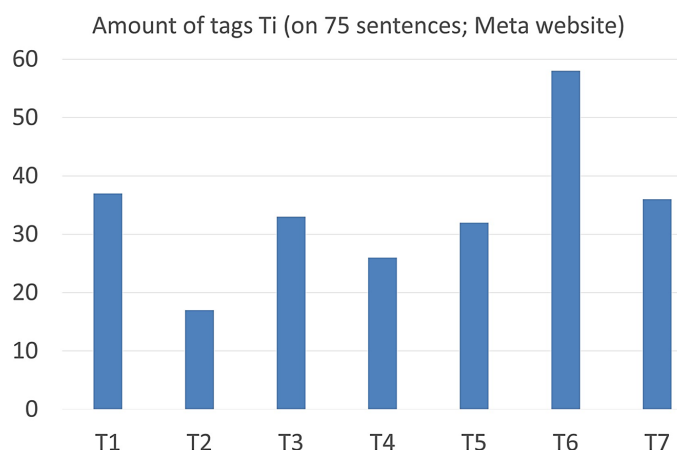
Figure 5. Histogram of the Ti tags assigned to sentences on the Meta website. An inspection was made of 75 sentences. The full tags are shown in Table A3. The (short) names of tags are: T1 = New social platform; T2 = Flooding mobile phones/devices; T3 = New internet; T4 = Doing activities of daily living; T5 = People meet/share experiences; T6 = Tearing down the boundaries; T7 = Living life in the metaverse.
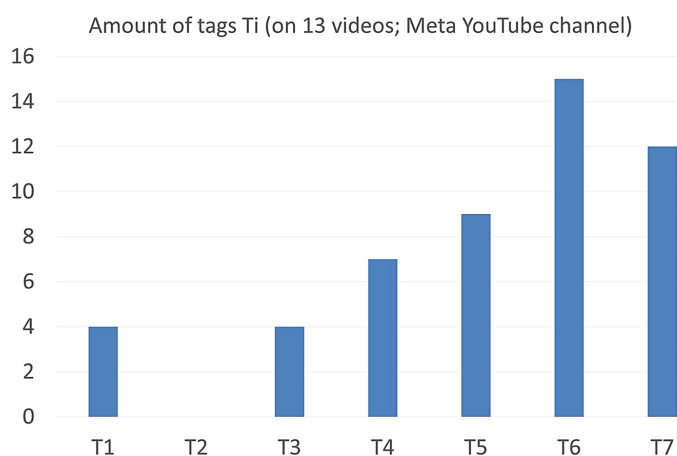
Figure 6. Histogram of the Ti tags assigned to videos watched on Meta YouTube channel. An inspection was made of 13 videos, randomly selected among dozens of available videos. The full tags are shown in Table A3. The (short) names of tags are: T1 = New social platform; T2 = Flooding mobile phones/devices; T3 = New internet; T4 = Doing activities of daily living; T5 = People meet/share experiences; T6 = Tearing down the boundaries; T7 = Living life in the metaverse.

The histograms of the tags show that the most frequently encountered concepts were "Doing activities of daily living" (T4), "People meet actively/share experiences" (T5), "Tearing down the boundaries" (T6), "Living life in the metaverse" (T7). The tags from website (Figure 5) were very frequently encountered, except "Flooding mobile phone and devices" (T2).

3. Questions about the "Social" Metaverse

Given that the purposes of the metaverse are not limited to social media and that Meta did not invent the metaverse or VR and AR, it is reasonable and realistic to consider the company as a reference player, since, currently, it is the most involved one in the development of a metaverse for social purposes, as also mentioned in [7]. This has been also confirmed by surveys (Sections 2.1–2.4) of the ideas of the metaverse developed by other companies: Microsoft is focusing on the metaverse for business/entertainment (gaming) purposes; Siemens focuses entirely on an "industrial" metaverse; while Apple and IBM only touch the topic a little.

The interpretation of the metaverse by Meta is never presented with features sounding like "useful facilities" or "solutions" or "tools" (software, apps) helping people to meet and to do things when (or if) they are in some kind of "difficulty" (for example: long travels, inability to move, pandemic, low budget, agenda full and so on). There is not just an offering of innovative and astonishing ICT applications and solutions; instead, a new level of socializing is proposed, by means of alternative virtual worlds. This emerged also from a video introducing Meta [40]. The concept of undertaking activities (associated with usual interrelationships in real life) in the virtual worlds coupled with the concepts of opportunity and feeling better than in reality, of tearing down the barriers of reality, makes us reflect. Potentially, it could be a paradigm shift in society. Therefore, we guess that it is reasonable to raise question, i.e., would people like such a "social" metaverse.

It is clear that nobody is obliged to participate or to live completely in a metaverse; on the other hand, it is well known how much the dynamics and the behavior of present-day society are mediated by the wide use of social media (for example, the authors of [41] reported that the number of internet users in October 2023 was around 5.3 billion, with 4.95 billion of them using social media). A metaverse for social purposes potentially could bring that to a higher order of magnitude. So, a literature review was done to find previous works about the question above.

4. Literature Review

A literature review was undertaken to identify previous works about aforementioned question ("Q"). The search, let's call it S1, was done on the Web of Science and Scopus databases [42,43] of document titles only, covering the period from January 2018 to December 2022 (the search strings are shown in Appendix C). The criteria for inclusion were that the titles and/or abstracts of papers had to be relevant to Q (completely or partially). A PRISMA flowchart of the process is shown in Figure 7. We found 1779 papers; after dropping duplicated documents, patents, documents not in English, datasets, clinical trials, the number of papers decreased to 111. After reading the titles and abstracts to identify the most relevant works, five papers were selected, all of them having been published in 2021–2022. Finally, two papers were retrieved. After a complete read, both [44,45] were considered to be about Q.

The work presented in [44] had two objectives. The first was "to generate new knowledge and gain a deeper understanding of the metaverse and the challenges that it faces in the future". The second was "to gain a better understanding of people's perceptions of the metaverse", which is a topic close to Q. To this end, a questionnaire was administered to 220 subjects (Appendix D).

The work in [45] is focused on the need to study the intention of participating in the metaverse (a topic close to Q) and on the involved psychological constructs, as literature is lacking in this respect. In this case, a questionnaire was administered to 450 Peruvian

citizens (Appendix D; the answers are not available); the first conclusion was that "institutional support, technological literacy and participation self-efficacy have a positive and significant effect on the intention to participate in the metaverse".
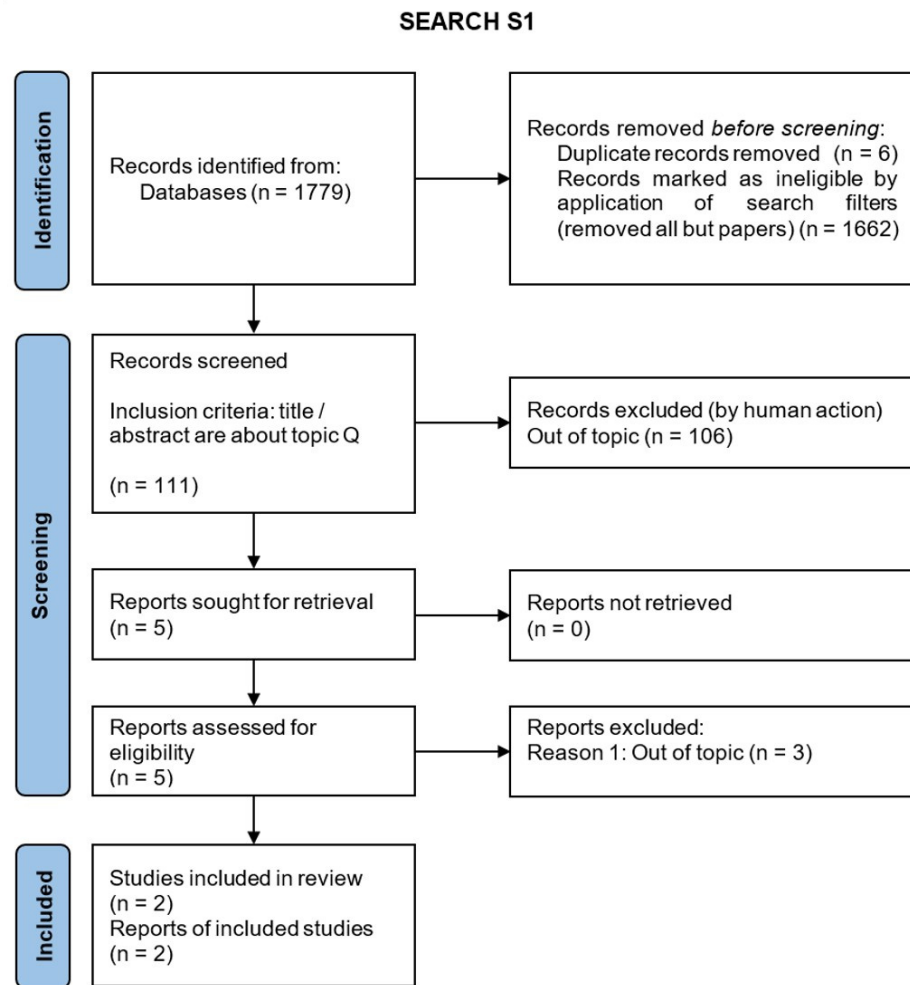
SEARCH S1

Figure 7. PRISMA flowchart of the review process of S1.

During our analysis of papers and some of the references mentioned therein, further works emerged. These works were focused on other themes connected to the metaverse, such as feasibility, enabling technologies, taxonomies, road mapping, and the current state of such technology. Such papers mentioned various topics (e.g., ethics, usage, or privacy issues) in a way that was also potentially related to Q. Therefore, a new literature review based on a search, let's call it S2, was done to identify previous works about the metaverse with questions about the future, ethics, humans, morality, which could still be relevant to Q. The search has been done on the Web of Science and Scopus databases, in document titles only and by covering the period from January 2010 to March 2023 (the search strings are shown in Appendix C). As with S1, the criteria for inclusion were that the titles and/or abstracts of papers had to be about topic Q (completely or partially). A PRISMA flowchart of the process is shown in Figure 8. We identified 730 papers. After dropping duplicated documents, patents, documents not in English, datasets, and clinical trials, the number of papers decreased to 410; after reading the titles and abstracts, 65 papers were selected, all of which were published in 2021–2023. Of these, 62 were retrieved. After a complete read, two papers [46,47] were found to be about Q.
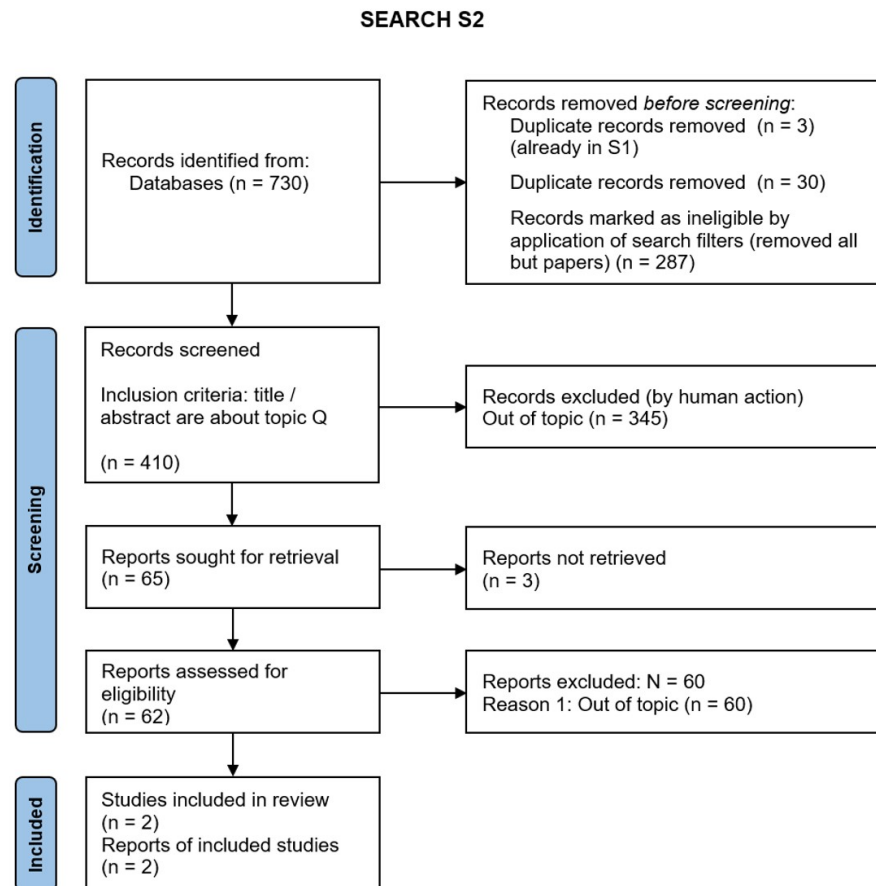
SEARCH S2

Figure 8. PRISMA flowchart of the review process for S2.

The work in [46] aimed to analyze the impact of the metaverse on humans, on one hand by consulting specific professionals such as therapists, psychologists, and neurologists, and, on the other hand, by administering a questionnaire to 250 subjects in order to understand people's view of the metaverse (see Appendix D).

The work in [47] comprised a study of the ethical implications of the metaverse in everyday life. It is remarkable that this work was probably the only one from S1 and S2 which took an explicitly critical position on the metaverse and was not directly favorable to it. It called for a "re-orienting" of the metaverse by paying more attention to human factors. The authors of [47] published the results of interviews [48] about people and the metaverse (a topic related to Q), where relevant percentages of subjects declared their concerns and fears (listed in Appendix D).

From S1 and S2, a few works emerged about Q. In these works, surveying tools, composed of many items, were administered to people, while Q was touched upon mainly in an indirect way, rather than going straight to the point. The results were fragmentary and heterogeneous; as such, a meta-analysis is out of the scope of this paper.

In order to identify a trend in terms of being "in favor" or "not in favor" of the metaverse for social purposes, from the questionnaires mentioned above (shown in Appendix D), items meeting the following criteria were selected:

- Answers were published;
- An item was relevant to Q or;
- An item was relevant to the personal and intimate sphere of the subject.

Items such as opinions about the economy, the pros and cons of a metaverse, the degree of knowledge of technology, and so on, were excluded.

Each selected item was classified as being either "in favor" or "not in favor", and has been labeled with a letter (A, B and so on). The result of this selection process is summarized in Figure 9.
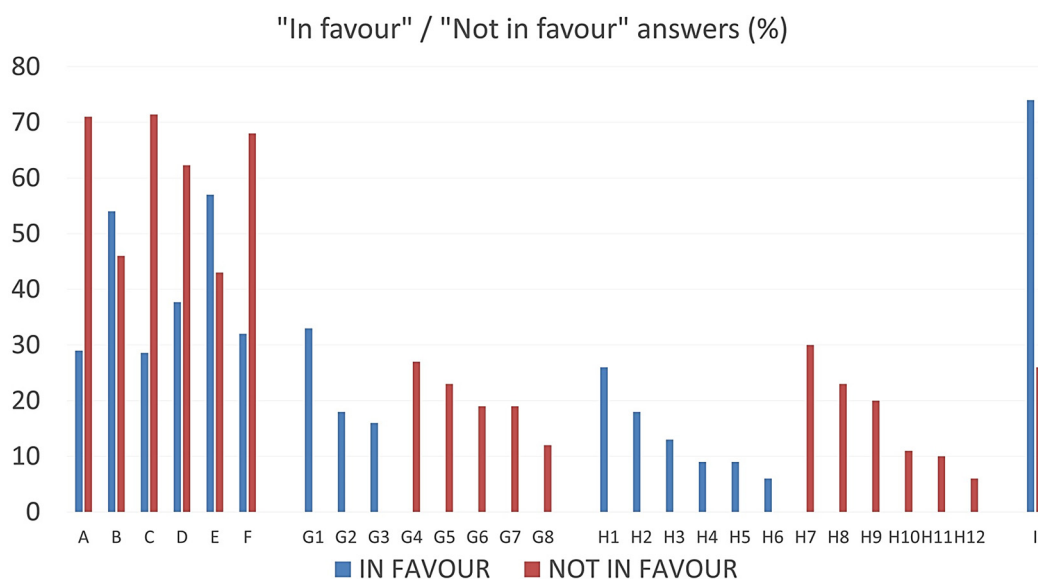
Figure 9. A plain histogram of answers "in favor"/"not in favor" (of "social" metaverse) emerged from the questionnaires found in S1 and S2. Each letter represents a selected surveying item. Items G and H were composed of different types of answers, shown respectively as G1–G8 and as H1–H12. The complete source questionnaires, scales, and all items are listed in Appendix D. The items shown in the histogram are: A = Have you been impacted by the internet? Would you say that the metaverse will affect you? B = Does the metaverse also free us from many of the limitations of the physical world? C = Can the Metaverse be a world where the digital world is more valuable than the physical world? D = Do you think you're ready for the metaverse? E = Does a Metaverse or a Virtual World excite you? F = Share of adults in the US who are interested in Meta's new virtual reality project, known as the metaverse, as of November 2021. G = Feelings toward the metaverse according to adults in the US as of January 2022 (response types: G1 = Curious; G2 = Excited; G3 = Optimistic; G4 = Uninterested; G5 = Suspicious; G6 = Concerned; G7 = Indifferent; G8 = Confused). H = Views on the metaverse according to adults in the US as of January 2022 (response types: H1 = The future of technology; H2 = A really exciting way to play/socialize; H3 = A way to intensify enjoyable experiences; H4 = A better alternative to real life; H5 = How we will do most of our shopping in the future; H6 = Will create more equality in society; H7 = Not good as real life; H8 = Tech companies trying to figure out a new way to make money; H9 = A big risk to personal privacy; H10 = A fad that will not last long; H11 = Something for young people only; H12 = A scam/predatory financial scheme). I = Share of adults in the US joining or considering joining the metaverse for various reasons as of December 2021.

A simple qualitative preliminary consideration could be that the found results approximately indicate that people giving answers favorable of the metaverse are balanced by or even fewer in number than people giving answers that were not favorable (Figure 9). Moreover, in such works, it is not clear whether people consider the metaverse as simply a new set of appealing social media functionalities, i.e., replacing Facebook, or something deeper. This simplistic assumption, that limits the understanding of the potential impact of the metaverse for social purposes, could also influence the answers (this issue was addressed in [46], where half of the subjects did not know what the metaverse is, so an idea about it was provided to them before doing the survey).

5. Draft Proposal of a Tool Assessing the Predilection to Use a "Social" Metaverse

The interpretation of the "social" metaverse reported in Section 2.5 can be considered as more interesting and profound than the usual common attributes (the metaverse is the future, you will be able to do whatever you want, and so on), because it has the potential (the intention?) to involve the most natural life habits. From S1 and S2, few documents emerged which had examined what people think about the potential future rise of the metaverse for social purposes. Therefore, a survey could reveal information about the position of people regarding participation in a "social" metaverse (that is the topic addressed in Q, defined in Section 3); it also could foster opinions or discussions about this question.

Questionnaires and scales are widely used surveying tools for measuring subjective feelings and positions. Many tools already exist for the assessment of specific technology features (as likeability, usability, acceptability, level of readiness, and so forth), for example Technology Acceptance Model (TAM) [49], Technology Acceptance Model v2 (TAM2) [50], Unified Theory of Acceptance and Use of Technology (UTAUT) [51], Technology Readiness Index (TRI) [52], Technology Readiness Level (TRL) [53,54], Human Readiness Level (HRL) [55], System Usability Scale (SUS) [56]. We found that such tools are not really suitable to investigate the topic touched on in Q, as they are aimed to be applied to technologies, i.e., to applications that are fairly specific, that are being implemented or are already working, to improve their characteristics for end users of industry and of organizations, and to enhance jobs. Instead, the features of a "social" metaverse embrace the field of human interactions and socializing. Moreover, these days, the metaverse appears to be not particularly suitable for specific surveys because it is not a specifically defined system, i.e., it is weakly diffused, and some of the required technologies (hardware and software) are still in development. An exception to this can be represented by the second version of "Unified Theory of Acceptance and Use of Technology" (UTAUT2) [57]. UTAUT2 extends the UTAUT model [51] to a consumer context by defining and including the constructs of "Hedonic Motivation", "Price Value", and "Habit" as elements influencing the "behavioral intention" of the subject to use a specific technology. The survey items of UTAUT2, according to the UTAUT model, address many specific pragmatic sides of using a given piece of technology.

Given the above considerations, the development of a new specific assessment tool may be a more focused approach. Likert scales [58,59] are widely used, self-reporting evaluation methods for measuring psychological constructs that, because of their nature, cannot be directly measured [60].

In this research, Q can be assessed by the quantification of the "predilection" to use a social metaverse, in terms of the intensity of positive feelings [61]. It is a subjective, non-observable, and not directly quantifiable variable. The Likert evaluation scale model is a tool that is suitable for such quantifications. Therefore, items for building a Likert scale assessing what Q is expressing in general terms could be designed and developed. This is made possible by focusing on the assessment of the construct, i.e., predilection for a new level of sociality in "social" metaverse (let's call it "C") and by specifically involving the design process from which those elements emerged as features of a "social" metaverse.

When a construct is a bipolar continuum, typically, its presence in the subject represents the high end of the evaluation scale, while its absence, at the low end of the scale, is associated with the opposite of that construct. On the other hand, when a construct is a unipolar continuum, the low end of the scale just represents its absence in the subject [62]. The characteristics of the metaverse for social purposes, as summarized in Section 2.5 and discussed in Section 3, reveal a shift from the real to the virtual world. So, in this context, an individual with a predilection for such social activities in the metaverse (construct C) can be deemed to be neglecting the same activities in real life; this is related to the opposite of C. Therefore, construct C can be considered a bipolar continuum ranging from "Strongly disagree" to "Strongly agree" (rather than an unipolar continuum ranging, for

example, from "Not at all" to "Extremely") [61]; these types of values convey a character of bipolarity [62,63].

According to the authors of [62], the type of gradation of C to be assessed is "behavioral extremity", since it represents feelings, thoughts, behaviors; while the degrees of C reflect the level of presence of C representing the bipolar continuum. The maximum value (the high end of the scale) and the minimum value (the low end of the scale) express a complete presence (or absence) of C in the subject; the absence, as stated above, conveys the opposite of C in the subject.

The regions of the continuum with topics identifying facets of C have been mapped. This process allowed us to generate an initial large pool of items (to be reduced after the administration to a representative sample of subjects and after the analysis of the obtained answers) with which we could appropriately measure C, that is, at the beginning of the construction process of the evaluation scale [61,62,64]. Each topic in the mapping included a set of items related to it. The mapping, shown in Table 1, included the features of the metaverse for social purposes, so it took into account some of the related descriptive tags. All the Ti tags are listed in Table A3.

Table 1. In the central column, the topics for generating the pool of items for assessing construct C are shown. In the right column, the tags (Ti) involved by topic are shown (or "-" is shown if the topic does not involve tags). The tags are described in Table A3.

Topic	Involved Tags
Experiencing real life situations in a virtual space	T4, T5, T6, T7
Actual needs of real life instead of an alternative life in the virtual space	T4, T6, T7
Satisfaction/limits/barriers of real life	T4, T6, T7
Being another being	T6, T7
Time spent in virtual space	-
Value of sharing in virtual space	-
Value of actions in virtual space	-
On-site stillness of immersion	-
Pervasiveness of devices for immersion	-
Immersion in virtual space	-

As shown in Table 1, the following tags were deemed suitable for expressing facets of construct C: "Activities of daily life" (T4), "People meeting actively/sharing experiences" (T5), "Tearing down boundaries" (T6), "Living life in the metaverse" (T7). Tags T4 and T5 are related to the concept of impacting the activities of daily life, while T6 and T7 are related to the broad concept of impact on the freedom of acting. All of them are mediated by the fundamental concept of sharing experiences with other people. Additionally, other topics, not corresponding to the aforementioned tags, were identified to cover other facets of C (in Table 1; mapped to "-"). Also, in the case of topics with no involved tags, the aim was to assess the predilection of individuals for the "activity", for the "situation" represented by the topic; the specific aspects and reactions related to the consequences of experiencing virtual environments (for example: motion sickness, sense of presence, sense of reality and so on) were not considered.

On the other hand, the tags "New social platform" (T1), "Flooding mobile phones and devices" (T2), "New internet" (T3) were less suitable, because they are less related to changes in human life habits and more related to characteristics which appear to the public (especially the disenchanted ones) as normal, current, typical of existing today apps. Tag T1 was about the concept of the metaverse as a new platform for social media, which sounds like "ok, we have just a new awesome social media platform"; everyday, new ICT technologies and apps populate the online space. Tag T2 was about the concept of people accessing such new social media platforms from any device; this is an already well-known feature that is typical of existing apps. Tag T3 was about the concept of the metaverse

becoming the new internet; this sounds like the "social internet has been renovated, with a new look, with new interfaces".

In a first preliminary reflection, our assessment of construct C addressed subjects aged 18–45 years; as shown in Table 2, this range was representative enough of potential and actual users. This range could be adjusted according to the characteristics of the population of a specific country or region. Moreover, people using and not using social media should be involved; the former could provide opinions as users already engaging with current social platforms (and skilled about), while the latter could provide opinions as "beginners" facing the concepts touched on in C.

Table 2. The percentages of users of Facebook and Instagram by age in January 2023. Source: [65,66]. In the left column, age range is shown. In the two center columns, percentages of Facebook users are shown. In the right column, percentages of Instagram users are shown. The values that are suitable for consideration are in bold underlined characters.

Age Range (Years)	Facebook Users %		Instagram Users %
	Male	**Female**	
13–17	2.7	2.1	8
18–24	**12.6**	**8.0**	**30.8**
25–34	**17.6**	**12.3**	**30.3**
35–44	**10.9**	**8.5**	**15.7**
45–54	6.1	5.5	8.4
55–64	3.5	3.8	4.3
>=65	2.6	3	2.6

6. Conclusions and Remarks

A perspective regarding the potential consolidation of actions of normal social life in a digital world emerged from a survey of the website of the Meta company, while other companies only loosely discussed the metaverse (Apple, IBM) or positioned themselves differently (Microsoft, Siemens) in relation to it. After searching the literature for works surveying opinions about question Q, few documents were found; most of the works found in the literature were focused on legal, ethical, and privacy aspects. These topics are often discussed as potential negative consequences of metaverse.

It is remarkable that most of the papers did not consider whether society in itself "wants" the metaverse (the authors of [15], mentioned in Section 1, touched on a similar topic in the field of mass media), also given that the vision of a "social" metaverse is not just related to entertainment and ICT services but also as a proposed new type of social life in the future. A curious aspect is represented by the fact that the technology push, typically used by the big tech companies, probably influences our point of view, so we tend to accept devices or paradigms coming from them, without questioning their suitability in our lives. This could be also an ethical component of the scenario. Therefore, in this paper, a preliminary analysis for the design of a Likert scale to assess the predilection of the public for a "social" metaverse has been outlined with the intent of bringing this topic to the foreground.

The presented work has limitations; the process is not complete yet, as the context could change in the future in relation to advances in the realization of "social" metaverse and in relation to behavior of other companies; the concepts and the tags summarizing views on the metaverse in this work have been outlined striving for an "objective" way, aware that it is intrinsically a subjective process (at least partially) and that some concepts could have been worded differently.

What has been designed is a draft concept underlying what should, in the future, be a questionnaire. The outcomes in the present work aim to contribute toward filling the gap in the topic of opinions about a "social" metaverse, by providing information that could be considered for further development, validation, and the application of the actual questionnaire.

Appendix A

The following URLs have been surveyed for analyzing Meta web (visited in 7–21 February 2023):

https://about.meta.com/uk/what-is-the-metaverse/
https://about.meta.com/uk/company-info/
https://about.meta.com/uk/metaverse/#go-further
https://about.meta.com/uk/metaverse/#flexnaija
https://about.meta.com/uk/metaverse/are-we-there-yet/
https://about.meta.com/uk/metaverse/impact/
https://about.meta.com/uk/metaverse/#shared-experiences
https://about.meta.com/uk/metaverse/#fitness
https://about.meta.com/uk/metaverse/#work
https://about.meta.com/uk/metaverse/#education
https://about.meta.com/uk/metaverse/#virtual-reality
https://about.meta.com/uk/metaverse/#augmented-reality
https://about.meta.com/uk/metaverse/#smart-glasses
https://about.meta.com/uk/technologies/
https://www.oculus.com/horizon-worlds/
https://www.meta.com/it/quest/fitness/
https://www.meta.com/it/quest/social/
https://www.meta.com/it/quest/entertainment/
https://www.meta.com/it/quest/productivity/
https://www.meta.com/it/work/
https://www.youtube.com/watch?v=hCUyd4Y-5lo
https://www.youtube.com/watch?v=SKnc-jqLZUs
https://www.youtube.com/watch?v=L4pnQFLmHds
https://www.youtube.com/watch?v=d3ZKSmCWwJw
https://www.youtube.com/watch?v=XHmwSSxHnDw
https://www.youtube.com/watch?v=ODt3nMXu7pg
https://www.youtube.com/watch?v=VQV9%C3%973P0TDY
https://www.youtube.com/watch?v=8Ao-JG4PrGs
https://www.youtube.com/watch?v=JXP0yW80gnw
https://www.youtube.com/watch?v=pjNI9K1D_xo
https://www.youtube.com/watch?v=5FwztKGQmd8
https://www.youtube.com/watch?v=afdnbXXbBTg
https://www.youtube.com/watch?v=gQdRW44yvKw

The following URLs have been surveyed for analyzing Microsoft web (visited in 26 February 2024–4 March 2024):

https://www.microsoft.com/en-us
https://www.microsoft.com/en-us/sitemap.aspx
https://www.microsoft.com/en-us/microsoft-teams/group-chat-software
https://www.microsoft.com/en-us/microsoft-teams/group-chat-software#video
https://www.microsoft.com/en-us/microsoft-teams/enterprise
https://news.microsoft.com/source/features/innovation/microsoft-mesh/
https://www.microsoft.com/en-us/microsoft-teams/microsoft-mesh
https://www.microsoft.com/en-us/microsoft-teams/microsoft-mesh#modal-11
https://www.microsoft.com/en-us/microsoft-teams/microsoft-mesh#Customer-stories

https://www.microsoft.com/en-us/worklab/the-future-of-hybrid-events
https://www.microsoft.com/en-us/microsoft-teams/virtual-events
https://www.microsoft.com/en-us/microsoft-teams/teams-for-home
https://support.microsoft.com/en-us/office/microsoft-teams-free-08fd2b61-1c3e-47e2-821b-d312709b933d
https://support.microsoft.com/en-us/office/create-a-meeting-in-microsoft-teams-free-eb571219-517b-49bf-afe1-4fff091efa85
https://www.microsoft.com/en-us/microsoft-teams/communities
https://www.microsoft.com/en-us/microsoft-teams/education
https://www.youtube.com/watch?v=Qw6UCwCt4bE
https://www.youtube.com/watch?v=wAlcX7QaWkc
https://www.youtube.com/watch?v=tTHk0riVQ-w
https://www.youtube.com/watch?v=BJljapGLmO0
https://www.youtube.com/watch?v=lM7Yfy0OGFU
https://www.youtube.com/watch?v=Jd2GK0qDtRg
https://www.youtube.com/watch?v=IkpsJoobZmE
https://www.youtube.com/watch?v=co6sQQ64yfk
https://www.youtube.com/watch?v=LwYhAcNC0Qs&t=0s
https://www.youtube.com/watch?v=uErR_3kmRUM
https://www.youtube.com/watch?v=pdSfgRYy8Ao
https://www.youtube.com/watch?v=Pk5BVxlKL5w
https://www.youtube.com/watch?v=fOzvOM7ZX2o
https://www.youtube.com/watch?v=fSKBHOWOcSM
https://www.youtube.com/watch?v=4m6QATJW99k
https://www.youtube.com/watch?v=esBzumV_59Q

The following URLs have been surveyed for analyzing Apple web (visited in 12–13 March 2024):

https://www.apple.com/
https://www.apple.com/store
https://www.apple.com/shop/buy-mac
https://www.apple.com/shop/buy-ipad
https://www.apple.com/shop/buy-iphone
https://www.apple.com/shop/buy-watch
https://www.apple.com/mac/
https://www.apple.com/ipad/
https://www.apple.com/iphone/
https://www.apple.com/watch/
https://www.apple.com/airpods/
https://www.apple.com/tv-home/
https://www.apple.com/services/
https://www.apple.com/shop/accessories/all
https://www.apple.com/apple-vision-pro/
https://www.apple.com/shop/buy-vision
https://www.apple.com/studio-display/
https://www.apple.com/business/
https://www.apple.com/education/
https://www.apple.com/healthcare/
https://www.apple.com/augmented-reality/
https://apps.apple.com/us/app/highrise-avatar-chat-play/id924589795
https://apps.apple.com/us/app/atlas-earth/id1567636697
https://apps.apple.com/us/app/metaverse-experience-browser/id1159155137
https://apps.apple.com/us/app/imvu-3d-avatar-creator-chat/id919745844
https://apps.apple.com/us/app/zepeto-avatar-connect-play/id1350301428
https://apps.apple.com/us/app/nevermet-vr-dating-metaverse/id1601331019

https://apps.apple.com/us/app/reality-become-an-anime-avatar/id1404176564
https://apps.apple.com/us/app/meta-life-second-metaverse/id1594359997
https://apps.apple.com/us/app/habytat-metaverse/id6446708699
https://apps.apple.com/us/app/cluster-metaverse-vr/id1490075175
https://www.youtube.com/watch?v=TX9qSaGXFyg
https://www.youtube.com/watch?v=IY4x85zqoJM
https://www.youtube.com/watch?v=Vb0dG-2huJE
https://www.youtube.com/watch?v=OushE7mq0Ak

The following URLs have been surveyed for analyzing IBM web (visited in 15–19 March 2024):

https://www.ibm.com/us-en
https://www.ibm.com/consulting/customer-experience
https://www.ibm.com/thought-leadership/institute-business-value/report/enterprise-metaverse
https://www.ibm.com/downloads/cas/47X4RZJQ
https://www.ibm.com/downloads/cas/GN7B276L
https://www.ibm.com/blogs/smarter-business/business/metaverse-spatial-platform-solution-overview/
https://www.youtube.com/watch?v=rrpE8bHvf0k
https://www.youtube.com/watch?v=rrpE8bHvf0k&list=PLoELubR45xwV1My2lk7aHZmwjiAtzEPMq
https://www.ibm.com/blog/5-ways-to-get-metaverse-ready/
https://www.youtube.com/watch?v=7xfX-dmA1Rc
https://www.youtube.com/watch?v=_tl2eR7qFNU

The following URLs have been surveyed for analyzing Siemens web (visited in 20–25 March 2024):

https://www.siemens.com/global/en.html
https://www.technologyreview.com/2023/03/29/1070355/the-emergent-industrial-metaverse/
https://plm.sw.siemens.com/en-US/teamcenter/
https://xcelerator.siemens.com/global/en.html
https://www.siemens.com/global/en/company/digital-transformation/industrial-metaverse.html
https://www.youtube.com/watch?v=gRHP2IiNXKo&t=5s
https://www.siemens.com/global/en/company/digital-transformation/industrial-metaverse/what-is-the-industrial-metaverse-and-why-should-i-care.html
https://www.siemens.com/global/en/company/digital-transformation/industrial-metaverse/industrial-metaverse-glossary.html
https://www.siemens.com/global/en/company/digital-transformation/industrial-metaverse/siemens-and-nvidia-partner-to-build-the-industrial-metaverse.html
https://www.siemens.com/global/en/company/insights/siemens-and-nvidia-bringing-the-real-and-digital-worlds-together.html
https://www.siemens.com/global/en/company/insights/the-rise-of-the-industrial-metaverse-and-its-economic-impact.html
https://www.siemens.com/global/en/company/digital-transformation/industrial-metaverse/redefining-reality-3-key-building-blocks-for-the-industrial-metaverse.html
https://www.siemens.com/global/en/company/digital-transformation/industrial-metaverse/digital-twins-first-strides-into-the-industrial-metaverse.html
https://www.youtube.com/watch?v=SLVhLpVPRrU
https://www.youtube.com/watch?v=LGgccYDyGFk
https://www.youtube.com/watch?v=S9wJ7R04wac
https://www.youtube.com/watch?v=W2dQupQFv_U
https://www.youtube.com/watch?v=IsQVAXRbDs4
https://www.youtube.com/watch?v=5EtqTpQ-7mI

https://www.youtube.com/watch?v=uIT02AZs5Is
https://www.youtube.com/watch?v=9c1hlwHSel8

Appendix B

The following Table A1 contains the tags synthetized from analysis of Microsoft web.

Table A1. On the left column, the tags MSTi are shown; they classify the concepts about metaverse emerged from analysis of Microsoft web. On the right column, a description of the corresponding tag is provided; the descriptions with (*) just come from sentences explicitly positioned in a context of work, of business, of entertainment (gaming).

Tag MSTi—Represented Concept	Tag MSTi—Description
MST1—Communicating, sharing, working with others	(*) The metaverse allows people to communicate, share data/experiences, work, do things together
MST2—Doing activities of daily living	People can do in the metaverse (usual) activities of their life
MST3—Connecting from everywhere/at any time	(*) People can jump in the metaverse simply when they want and wherever they are
MST4—Representing yourself the way you want	(*) People can customize the avatar as they prefer
MST5—Representing yourself to reflect yourappearance/to express yourself	(*) People can customize their avatar to an appropriate representation of themselves
MST6—Removing the barriers	(*) People can keep in touch and act, no matter the place they are, the language they have (AI translations) and other "limitations". This allows to avoid issues of connection/presence/language, of personal life situations
MST7—Freeing up budget	Money can be saved in all those processes involving travelling/conferencing/venue costs and so on
MST8—New internet	The metaverse is a new version of internet
MST9—It can damage health	A present time, a long immersion in the metaverse (with headset) can damage health
MST10—It works on most/all devices	Metaverse can run on all the available devices
MST11—Improving quality of actions/experiences	(*) Doing things in the metaverse allows people to enhance, improve the quality of actions/experiences themselves

The following Table A2 contains the tags synthetized from analysis of Siemens web.

Table A2. On the left column, the tags STi are shown; they classify the concepts about metaverse emerged from analysis of Siemens web. On the right column, a description of the corresponding tag is provided.

Tag Sti—Represented Concept	Tag Sti—Description
ST1—Three sectors	The metaverse is present in three sectors of application: industrial, enterprise, consumer
ST2—Digital twin, software-defined automation, data and AI	The pillars of industrial metaverse are digital twin, software—defined automation, data and AI (especially generative AI)
ST3—The digital twin is the main pillar	The digital twin is the core main pillar of the whole industrial metaverse
ST4—Always on/persisting	The industrial metaverse is always running, is always on, it is a persisting system
ST5—Combination of real and digital world	In the industrial metaverse the digital and the real world are combined, joined together
ST6—Connecting real to digital to simulate and solve	In the industrial metaverse the real and digital world are connected together, by including also people, for simulating and solve problems of systems

Table A2. *Cont.*

Tag Sti—Represented Concept	Tag Sti—Description
ST7—Capability to solve real world problems	The industrial metaverse allows the capability to face and solve real-world problems that can be also very complex
ST8—Simulating/testing the whole thing	The industrial metaverse allows simulating/designing/testing/tuning the whole thing, or any side of the thing, before doing it/building it in real world or also during the real operation
ST9—Simulating/testing at high speed	The industrial metaverse allows to simulate/test/tune at unimaginable speed
ST10—Making decisions	In the industrial metaverse you can make better decisions/faster decisions
ST11—Allowing safe environments	The industrial metaverse is a virtual environment for doing experiments and actions in a safe way for people and for real environment
ST12—Allowing sustainability	The industrial metaverse allows to include matters of sustainability in simulations and optimizations
ST13—Saving time/money/resources	The digital world of simulations in industrial metaverse allows to save time, money, resources
ST14—Improving/impacting the real world	The industrial metaverse is something actually impacting the real world/making the real world better
ST15—Realtime collaboration	In the industrial metaverse the collaboration of people is in realtime
ST16—Collaborating/interoperating across systems	The industrial metaverse allows collaboration/interoperation of people/of applications across several platforms, devices, organizations, locations
ST17—Avatars for recognizing/interacting/improving	In the industrial metaverse people can use avatars for recognizing other people/for interacting with operators/for improving the job
ST18—Full immersion/like a real environment	The industrial metaverse is a fully immersive virtual environment, it is like the real environment
ST19—New way of interaction/collaboration	With the industrial metaverse new ways of interaction/of collaboration are unlocked
ST20—Changing the way organizations operate	The capabilities, the features of the industrial metaverse make organizations change the way they operate (in a better way)
ST21—Getting benefit from skills of people	In the metaverse the companies can find and get benefit from specific skills of people, by facing the shortage of skilled operators, wherever they are in the world
ST22—Supporting/motivating people	The industrial metaverse is a set of technologies allowing the engagement/the support/the motivation of people at work
ST23—Breaking down the barriers of distance	With the industrial metaverse there is no need to travel/the barriers of geographical distance among people are broken down
ST24—Saving costs for travelling	In the industrial metaverse there is no need to travel; similarly, the related costs are saved too
ST25—Need to face the possible fears of workers byexplaining opportunities/innovation	With the incoming industrial metaverse the companies can teach their workers the new opportunities offered
ST26—A new plane of existence/it changes our lives	The industrial metaverse, with all the technologies, the opportunities, the advantages it brings, can be considered as changing our lives
ST27—Doing activities of daily living	People can do in the metaverse the usual activities of their life
ST28—It will live in the internet 3.0	The industrial metaverse is a new face of internet/the internet 3.0
ST29—It is real/an emerging reality	The industrial metaverse is not an hype, it is a real thing and it is already happening

The following Table A3 contains the tags synthetized from analysis of Meta web.

Table A3. On the left column, the tags Ti are shown; they classify the concepts about metaverse emerged from analysis of Meta web. On the right column, a description of the corresponding tag is provided.

Tag Ti—Represented Concept	Tag Ti—Description
T1—New social platform	The metaverse will be the new platform for new social media
T2—Flooding mobile phones and devices	The metaverse will run on most devices as possible -smartphones, tablets, headsets, computers and other smart devices.
T3—New internet	The metaverse will be the new internet with infrastructure of contents
T4—Doing activities of daily living	People can do (or are "encouraged" to do) in the metaverse the usual activities of their life
T5—People meet actively/share experiences	People, with particular attention to relatives and friends, meet in metaverse and together they do actions and/or share experiences (depending on the context of specific sentence, this may evoke -also implicitly- no need to do it in reality)
T6—Tearing down the boundaries	The metaverse allows to do anything, by tearing down the boundaries/barriers/limits of reality (depending on the context of specific sentence, this may be also implicit)
T7—Living life in the metaverse	People can do/transfer actions typical of real life in the metaverse

Appendix C

The following search string has been used for search S1 in Web of Science (all databases, all collections):

TI = ((people OR citizen* OR user* OR "end user" OR "end users" OR society OR mainstream OR compan* OR audience) AND ("virtual reality" OR metaverse OR "meta" OR "immersive technology" OR "immersive technologies" OR "virtual world" OR "virtual worlds" OR "VR world" OR "VR worlds" OR HMD OR "head mounted display") AND ("don't want" OR "dont want" OR "do not want" OR "want it" OR want* OR deal* OR apprec* OR curio* OR expectation* OR accept* OR interest* OR enjoy* OR engage* OR involve* OR participat* OR future)) NOT TI = "meta-analysis" NOT TI = "meta-analysis" NOT TI = metaanalysis NOT TI = "meta analyses" NOT TI = "meta-analyses" NOT TI = metaanalyses NOT TI = "meta review" NOT TI = "meta-review" NOT TI = metareview

The following search string has been used for search S1 in Scopus:

TITLE ((people OR citizen* OR user* OR "end user*" OR society OR mainstream OR compan* OR audience) AND ("virtual reality" OR metaverse OR "meta" OR "immersive technolog*" OR "virtual world*" OR "VR world*" OR hmd OR "head mounted display") AND ("don't want" OR "dont want" OR "do not want" OR "want it" OR want* OR apprec* OR curio* OR expectation* OR accept* OR interest* OR enjoy* OR engage* OR involve* OR participat* OR future) AND NOT "meta analys*" AND NOT "meta-analys*" AND NOT metaanalys* AND NOT "meta review" AND NOT "meta-review" AND NOT metareview) AND PUBYEAR > 2017

The following search string has been used for search S2 in Web of Science (all databases, all collections):

TI = (metaverse AND (issue* OR problem* OR ethic* OR concern* OR substitut* OR future OR challeng* OR insight* OR alternat* OR roadmap* OR opportunit* OR possibilit* OR "3D virtual world" OR "3D virtual wolds" OR moral* OR achiev* OR dawn OR horizon* OR existence* OR realm* OR realit* OR social* OR societ* OR good OR avatar* OR behaviour* OR behavior* OR extens* OR extend* OR human* OR man OR world* OR health* OR mental* OR mind*))

The following search string has been used for search S2 in Scopus:

TITLE (metaverse AND (issue* OR problem* OR ethic* OR concern* OR substitut* OR future OR challeng* OR insight* OR alternat* OR roadmap* OR opportunit* OR possibilit* OR "3D virtual world*" OR moral* OR achiev* OR dawn OR horizon* OR existence* OR realm* OR realit* OR social* OR societ* OR good OR avatar* OR behaviour* OR behavior* OR extens* OR extend* OR human* OR man OR world* OR health* OR mental* OR mind*)) AND PUBYEAR > 2010

Appendix D

In this Appendix D are listed the questionnaires, scales items, links to interviews (with related results, when available) about metaverse; they also contain the topics that are close to Q ([44–48]), found in works selected from S1 and S2. The specific items assessed as close to Q have been selected (shown in *Underlined Italic Style*) and labeled with a letter ("A -", "B -" and so on). The selected items have been classified as "In favor" or "Not in Favor" (of metaverse) according to the percentages of answers. The results of this selection process are summarized in Figure 9.

The following is the questionnaire about metaverse in [45] (found in S1). It includes questions both in closed-form and in open-form.

The following are the questions in closed-form (Yes, No, Not Sure):

- Have you heard about the metaverse? (79.5% = Yes);
- Would you consider the metaverse to be the next evolution of the internet? (58.6% = Yes, 16.4% = No, 25% = Not Sure);
- Do you believe that the metaverse can reshape the future? (70.9% = Yes, 8.2% = No, 20.9% = Not Sure);
- Would you consider the metaverse the next frontier for online interaction? (75% = Yes);
- Would you agree that the metaverse will revolutionize online marketing in the same way that social media did? (results not shown);
- A—*Have you been impacted by the internet, Would you say that the metaverse will affect you?* (29.1% = Yes, 25.5% = No, 45.5% = Not Sure)

  In favor = 29% Not in favor = 71%;

- B—Does the metaverse also free us from many of the limitations of the physical world? (54% = Yes)

  In favor = 54% Not in favor = 46%;

- What is your opinion of the effect of metaverse on the economy? Are there opportunities for the economy to grow in the metaverse? (66.8% = Yes);
- Would you agree that the metaverse has tremendous potential to transform and improve fields (like health care, education, entertainment, and so on)? (78.6% = Yes) (this is question mentioned in the paper but, in the questionnaire, it is different);
- C—*Can Metaverse be a world where the digital world is more valuable and valuable than the physical world?* (28.6% = Yes, 37.7% = No, 33.6% = Not Sure)

  In favor = 28.6% Not in favor = 71.4%;

- Are you concerned that we may lose our connection to the real world with the metaverse? (63.2% = Yes, 20.5% = No, 16.3% = Not Sure);
- D—*Do you think you're ready for the metaverse?* (37.7% = Yes, 17.3% = No, 45.0% = Not Sure)

  In favor = 37.7% Not in favor = 62.3%;

- The metaverse is expected to fundamentally alter digital communication (75% = Yes, 8% = No, 16% = Not Sure) (question mentioned in the paper but not included in the questionnaire).

The following are the questions in opened-form:

- In your own words, how would you describe the metaverse?

- How far away do you think the metaverse is?
- In your opinion, who will benefit from using metaverse? (the majority of respondent = entertainment industry)
- Is there anything you would like to see in the metaverse?

The following are the subscales about Self-Efficacy and Intention to Participate, in [45] (found in S1). The subscales are aimed to validate the psychological constructs developed in the work. The responses are not shown in the original paper.

The following are the items of the subscale for Self-Efficacy of participating in the Facebook metaverse:

- Participating in the metaverse advertised by Facebook is a task I can perform;
- I have the necessary technological skills to participate in the metaverse advertised by Facebook;
- I have sufficient technological skills to participate in the metaverse advertised by Facebook;
- I will be able to combine my daily activities with my participation in the Facebook Metaverse.

The following are the items of the subscale for Intention to Participate in the Facebook metaverse:

- I plan to participate actively in the metaverse announced by Facebook;
- I will actively shop in the metaverse advertised by Facebook;
- I am interested in participating in job interviews in the metaverse advertised by Facebook;
- I am interested in taking training courses in the metaverse advertised by Facebook;
- I am interested in getting a new romantic partner in the metaverse advertised by Facebook;
- I will recommend my friends to participate actively in the metaverse advertised by Facebook;
- I will recommend my partner to participate actively in the metaverse advertised by Facebook;
- I will recommend my relatives to participate actively in the metaverse advertised by Facebook.

The following is the questionnaire about metaverse, in [46] (found in S2). The questions are in closed-form (Yes, No, Maybe):

- (What age group do you belong to?);
- Do you know what the metaverse is? (53% = No; "did not know what a metaverse is and had to be given an idea about a metaverse before attempting the survey.");
- E—*Do you think a Metaverse or a Virtual World excites you?* (57% = Yes, 12% = No, 31% = Maybe)

  In favor = 57% Not in favor = 43%;

- Do you think a Metaverse could create a physical communication gap between humans, and also cause hindrance in physical relationships? (47.4% = Yes, 14.3% = No, 38.2% = Maybe);
- Do you think the virtual sphere including the existing social media platforms give rise to abuse and harassment? (36.3% = Yes, 22.3% = No, 41.4% = Maybe);
- Do you think a metaverse could reduce physical activities in humans? (65.3% = Yes, 11.2% = No, 23.5% = Maybe);
- Are you concerned about your data and privacy and feel unsafe about a Metaverse? (results not shown in the paper).

The following are the reports of statistics about metaverse from interviews to samples of citizens from United States, in [47] (found in S2; sources in [48,67–70]):

- F—Share of adults in the United States who are interested in Meta's new virtual reality project known as the metaverse as of November 2021 [67]. Original question: "Based

on what you know, how interested are you in using Facebook's new virtual reality project, metaverse, which would allow users to interact with each other in a computer generated environment? (values > 100% due to rounding)"

Results: Not that/At all interested = 68%, Very = 32%
In favor = 32% Not in favor = 68%;

- G—*Feelings toward the metaverse according to adults in the United States as of January 2022* [68]. Original question: "Which of the following best describes how you feel about Metaverse? -Select one"

  Results: Curious = 33%, Uninterested = 27%, Suspicious = 23%, Concerned = 19%, Indifferent = 19%, Excited = 18%, Optimistic = 16%, Confused = 12%, None of these = 7%
  In favor: Curious = 33%, Excited = 18%, Optimistic = 16%
  Not in favor: Uninterested = 27%, Suspicious = 23%, Concerned = 19%, Indifferent = 19%, Confused = 12%
  Note: the total amount is >100% but the access to [68] (free access) did not allow to see the results in detail
  The item "None of these" (7%) has been excluded;

- H—*Views on the metaverse according to adults in the United States as of January 2022* [69]. Original question: "[…] In the Metaverse, you could do many of the things you do now such as socialize with others, play games, watch concerts, and shop for digital and non-digital items such as clothing, home goods, and cars. Which of the following describe your views on Metaverse? -Select all that apply"

  Results: Not good as real life = 30%, The future of technology = 26%, Tech companies trying to figure out a new way to make money = 23%, A big risk to personal privacy = 20%, A really exciting way to play and socialize = 18%, A way to intensify enjoyable experiences = 13%, None of these = 11%, A fad that will not last long = 11%, Something for young people only = 10%, A better alternative to real life = 9%, How we will do most of our shopping in the future = 9%, Will create more equality in society = 6%, A scam or predatory financial scheme = 6%
  In favor: The future of technology = 26%, A really exciting way to play and socialize = 18%, A way to intensify enjoyable experiences = 13%, A better alternative to real life = 9%, How we will do most of our shopping in the future = 9%, Will create more equality in society = 6%
  Not in favor: Not good as real life = 30%, Tech companies trying to figure out a new way to make money = 23%, A big risk to personal privacy = 20%, A fad that will not last long = 11%, Something for young people only = 10%, A scam or predatory financial scheme = 6%
  The item "None of these" (11%) has been excluded;

- I—Share of adults in the United States joining or considering joining the metaverse for various reasons as of December 2021 [70]. Original question: not available

  Results: Joining or considering joining = 74%
  In Favor = 74%; Not in favor = 26%.

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