
Miscellaneous

Carolina Sáez-Linero

<https://orcid.org/0000-0002-5116-3606>

carolina.saez@upf.edu

Universitat Pompeu Fabra

Mònika Jiménez-Morales

<https://orcid.org/0000-0002-4977-0722>

monika.jimenez@upf.edu

Universitat Pompeu Fabra

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Young, lower-class, and algorithmically persuaded: exploring personalized advertising and its impact on social inequality.

Abstract

Algorithmically personalized advertising is a defining feature of the digital ecosystem, yet its potential to reinforce social inequalities remains underexplored. This study examines how socioeconomic status and gender intersect to influence exposure to personalized advertisements on platforms like Instagram and TikTok. Using online survey data from 1,200 participants aged 16 to 25, regression analyses reveal that young people from lower socioeconomic backgrounds are disproportionately targeted with ads promising easy income, quick earnings, and social mobility. They are also more likely to encounter ads related to gambling, online games, and financial services such as quick loans. These patterns are particularly pronounced among young men. Our findings highlight how social media platforms leverage massive data collection to infer sensitive attributes such as socioeconomic status, which includes complex information like education level, employment status, income, or migration background. This profiling exacerbates inequalities, as algorithmic advertising perpetuates both class-based barriers and gender stereotypes. Women are predominantly targeted with ads related to beauty, parenting, and education, while men are more exposed to ads for sports, alcohol, and politics. By

applying an intersectional lens, this study underscores how algorithmic systems exploit vulnerabilities tied to overlapping identities, trapping the most vulnerable youth in a cycle of digital inequality. These findings emphasize the need for greater transparency in advertising algorithms and robust regulatory measures to ensure that personalization technologies foster equity rather than deepening societal divides.

Keywords

Algorithmic Advertising, Personalized Ads, Social Inequality, Gender Stereotypes, TikTok, Instagram, Young Audiences, AI-Driven Profiling, Intersectionality, Hyper-Personalization.

1. Introduction

According to International Advertising Bureau (IAB, 2024), Internet advertising revenues reached their highest recorded level of \$225 billion between 2022 and 2023. This was an increase of almost 8% over 2022. Travel, fast food restaurants, alcoholic drinks, financial services, and technology are the most advertised product categories. In terms of investment, digital video ranks first (22,4%), followed by paid search (16%). Social media is in third position (15,9%).

The use of Artificial Intelligence (AI) in persuasive communication has played an important role in the growing correlation between investment and economic return in digital media. Real-time data analysis, target segmentation, personalization of advertising messages, and automation are some of the benefits of using advanced algorithms to interact with users on their digital devices. In this sense, there is a broad consensus that the use of AI in advertising has mainly increased efficiency (Kietzmann et al., 2018; Li, 2019; Rodgers et al., 2022).

At the same time, many voices have been raised against the use of AI in advertising, not so much concerning content creation but especially target segmentation and, in particular, the personalization of persuasive messages based on the user's digital behavior. This concern is particularly significant about so-called vulnerable audiences and, in particular, minors and young adults who, at the mercy of artificial intelligence, are exposed to advertisements for all kinds of products, many of them with a huge negative impact on their health, simply as a result of algorithmic patterns generated from their online behavior and data (Feijóo & Sádaba, 2022; Gran et al., 2020; Ragnedda, 2020; Ragnedda et al., 2022).

In this sense, authors such as Atkinson et al. (2016) point out that young people do not have to engage with such content to be exposed to it actively. Exposure may result from the algorithm predictions of social media, which allow individuals to be targeted by alcohol brands, for example, based on their interactions with third-party content.

In the same perspective, Radesky et al. (2020) argue that young audiences may be able to recognize advertising but often are not able to resist it when it is embedded within trusted social media, encouraged by celebrity influencers, or delivered next to personalized content. The authors determine that, unlike adults, minors do not have the critical capacity to understand the persuasive intent of much of the content they receive through social media. For this reason, they are especially critical of the lack of regulation in the use of artificial intelligence in advertising aimed at young audiences.

AI allows advertisers to contact, track, and influence users, as guided by behavioral data collection: a user's digital trail of location, activities, in-app behavior, likes, and dislikes contributes to a digital profile shared among many companies that can be used to make advertising messages more effective (Wu & Wen, 2021).

2. Digital advertising and socioeconomic position as a risk factor

For decades, advertisements for junk food, technology, or alcoholic beverages have occupied hours and hours of television or privileged spaces in newspapers and magazines, among others. Advertising spend in digital media often reflects the product categories most advertised in conventional media. Advertisements are repeated *ad infinitum* in the offline and online worlds: burgers coexist with the latest models of smartphones, and perfumes are mixed with financial products that promise to make us rich without the slightest effort. The difference between the persuasive messages from both universes - the real and the virtual - lies in the fact that offline media distribute them massively based on audience data of

approximate characteristics, while online media deliver their messages with a certain meticulous and exact precision.

Like a decade ago, the most advertised products include fast food, travel, alcoholic beverages, technology, and financial products. Except for travel, the products that attract the most advertising investments globally are associated with several public health issues: frequent consumption of alcoholic beverages can lead to alcoholism, extensive junk food consumption can result in overweight or obesity, and excessive technology use may contribute to screen addiction.

Beyond these, there is a category that, under the name of "financial services and products," groups together a series of articles under a unique selling proposition: that of maximizing profit with minimal effort. Banks that promise loans without prior capital, offer advice on purchasing cryptocurrencies, invest in supposedly profitable products, and promote gambling and betting are some of the most advertised offerings in this category.

Gambling has increased significantly worldwide in recent years. Some authors point out that, rather than being in decline, interest in gambling has been rising, particularly among vulnerable groups. Males, young adults, and those with low incomes are almost universally found to be at heightened risk (Abbot, 2020; Gómez et al., 2020; Pisarska & Ostaszewski, 2020). Of particular concern for public health is the fact that this increase is especially pronounced among young adults and adolescents.

According to Molinaro et al. (2018), recent research suggests that participation in online gambling is significantly associated with higher rates of gambling among minors. Additionally, we must consider that children typically receive their first smartphone around age 12, granting them free access to social media platforms where advertising appears in various formats.

Gambling advertising regulation differs substantially from country to country. This disparity of criteria, the lack of clear regulation regarding online content creation, and the rapidly changing landscape of targeted marketing (Hartmann et al., 2024) are the perfect breeding grounds for adolescents and young adults to be frequently exposed to gambling-related content and advertisements.

As already mentioned, the fact of being male, young adults, and low income are some of the risk factors that are correlated in the case of gambling. These factors coincide with pathologies such as obesity, alcoholism, or screen addiction (Buscemi et al., 2021; Friedman & Laurison, 2020). Consequently, there is a correlation between the most advertised products and the pathologies most present in the less favored social groups.

3. Algorithms, personalized advertising, and its social impact

Algorithmically delivered advertising adds complexity to the equation of advertising exposure and individuals' vulnerabilities. Personalized advertising involves monitoring and analyzing user behavior to create detailed consumer profiles, raising significant concerns regarding privacy, power dynamics, and exploitation (Zarouali et al., 2022)

One of the main concerns raised is the collection and use of personal data. Beyond a privacy issue, this data enables targeting specific demographic groups with personalized messages, improving the ability to manipulate advertising. On the other hand, this selection of audiences exacerbates information asymmetry between demographic groups and also creates a power imbalance between those who do and do not own the data. This imbalance limits users' agency and decision-making in favor of large companies like Meta or Google. Additionally, the circular nature of the algorithms' operation, which is fed and perfected with new data, allows the reproduction of prejudices and stereotypes that exist in society. Finally,

biases can manifest because machine learning models can be trained on faulty and biased data. Consequently, algorithms can lead to discriminatory results, expanding their power of persuasion (Calo, 2014; Gao et al., 2023; Zarouali et al., 2022)

Taking personalized advertising as a starting point, this research analyzes how socioeconomic position influences the type of advertisements shown to adolescents and young people on social media. Additionally, the study explores whether these persuasive messages perpetuate the class ceiling and reinforce gender stereotypes among users.

Socioeconomic position, a complex construct, can be addressed through various measures. In this study, we use an index that integrates factors such as income, education, employment, and migratory background—highly reliable indicators of different dimensions of social inequality (Barone et al., 2022). Although such data are typically not shared on social networks, based on the theories above, we postulate that algorithmic profiling systems can infer this information. Therefore, we propose the following hypotheses:

H1. Socioeconomic status will influence exposure to personalized ads.

In turn, socioeconomic status can become valuable information to target specific persuasive messages successfully. As previous literature points out, algorithms can infer the vulnerabilities of individuals, which for the less well-off may be the desire to prosper on the social ladder.

H2. Therefore, the lower the socioeconomic level, the greater the probability of receiving advertisements whose persuasive message focuses on the promise of economic improvement and social success.

Finally, to fully understand discrimination, it is essential to recognize that people's different identities, such as class and gender, intersect and overlap (Crenshaw, 1991). Consequently, we expect an interaction between gender and socioeconomic status in a way that creates double discrimination based on class and gender. The question arises regarding what this intersection can translate into, leading us to the following research question.

RQ1. How do socioeconomic level and gender affect exposure to personalized ads?

4. Methods

This study employed a quantitative research design to explore the interaction between socioeconomic position and exposure to personalized advertising on social media platforms, specifically Instagram and TikTok. The research instrument consisted of a structured online self-administered survey. Ethical approval was obtained from the Institutional Commission for Ethical Review of Projects at Pompeu Fabra University (CIREF-UPF), and survey administration was facilitated through a panel provided by the online research company Dynata during the last quarter of 2023.

The company was selected as the panel provider due to its extensive first-party dataset, composed of individuals who voluntarily join its platform. This enables researchers to distribute surveys directly to participants and collect responses firsthand. Its vast database in Spain, which includes active Instagram and TikTok users aged 14 to 30, makes it particularly well-suited for this study. However, the sample could not fully represent the general population due to the specificity of the eligibility criteria, which requires both an age range and active use of two social media platforms. Despite this limitation, the diversity and representativeness within the target group helped minimize selection bias and enhance data reliability.

A preliminary pre-test was conducted in September 2023 with 40 volunteers to refine the questionnaire and ensure its clarity and effectiveness. Five participants completed the survey in person, allowing them to provide immediate feedback and share their thoughts on the

questions. Based on the feedback received, minor adjustments were made to the wording of some items to improve clarity. This data was not analyzed due to the low variability in the preliminary sample.

4.1. *Sample*

The study involved $N = 1,200$ respondents, drawn from a population of approximately 8.45 million individuals aged 14 to 30 in Spain (INE, 2022). According to recent estimates, 90% of Spaniards aged 16 to 24 and 85.4% of those aged 25 to 34 actively use social media (INE, 2023). Based on these figures, an intermediate weighted estimate of 88.47% was calculated for individuals aged 14 to 30, resulting in an adjusted target population of approximately 7.48 million potential users of social media platforms. While the exact number of individuals who use both Instagram and TikTok simultaneously is unknown, this estimate strengthens the relevance of the sample to the studied phenomenon, even if it limits the generalizability to all young Spaniards. A margin of error of $\pm 2.83\%$ was calculated at a 95% confidence level, ensuring sufficient precision for estimating population parameters within the adjusted target population.

The participants' age distribution was as follows: 10% were aged 14–17, 59% were 18–24, and 31% were 25–30. Age groups conducted no analyses, as the study already focuses on a specific demographic subset of the population. Regarding gender, 30% identified as male, 67% as female, 2% as non-binary, and 1% preferred not to disclose their gender. Margins of error for gender subgroups were $\pm 3.46\%$ for women ($n = 804$) and $\pm 5.16\%$ for men ($n = 360$). Non-binary individuals ($n = 24$) and those who preferred not to disclose their gender ($n = 12$) were excluded from gender-based analyses due to their small sample sizes, which would result in excessively high margins of error and unreliable estimates.

Regarding socioeconomic status, 8% were categorized as high status, 41% as high-medium, 46% as low-medium, and 6% as low status. However, all statistical models analyzed the socioeconomic level on a continuous scale. This approach ensured that the full sample contributed to the analysis, minimizing concerns about subgroup sizes and allowing robust estimations.

Although the sample does not fully represent the general population—partly due to the lack of precise data on the target population—it was purposefully designed to focus on a specific demographic: active Instagram and TikTok users aged 14 to 30 in Spain. This well-defined target group aligns with the study's objectives and ensures the reliability and relevance of the findings.

4.2. *Measures*

4.2.1. *Socioeconomic Status*

To effectively assess the participants' socioeconomic position, their addresses were matched with a publicly available open-access synthetic index that consolidates various socioeconomic characteristics into a single value. The index encompasses two indicators for employment status, two for educational level, one regarding immigration, and one for income. For this study, the last data from the 2020 edition were used (Idescat, 2021).

The individuals' index scores are based on deviations from the average value (set at 100): scores below 80 indicate low social status; scores between 80 and <100 correspond to low-medium social status; scores between 100 and <120 represent high-medium social status, and scores exceeding 120 are categorized as high social status.

This methodological approach is crucial because when respondents self-report their socioeconomic situation, an overwhelming majority locate themselves in the middle strata of

the socioeconomic scale, even if they are above or below the average (Evans & Kelley, 2004). Furthermore, young people still move between their parents' social class and their own, demonstrating difficulties in understanding their actual socioeconomic circumstances (Goodman et al., 2001).

4.2.2. Types of advertising exposure

To examine advertising exposure across different socioeconomic statuses, participants were asked to identify the types of ads they typically encountered on their social media feeds. Various ad categories were presented in a checkbox format based on Instagram and TikTok's advertiser classification options. To ensure participants referenced personalized ads on their social media platforms, they were specifically asked to consider ad topics that spontaneously appeared on their Instagram or TikTok feeds, excluding content from accounts they follow. Participants could select multiple ad categories or indicate if none of the options applied. Additionally, an open-ended field allowed for the inclusion of extra ad categories. For a comprehensive list of the ad categories provided to participants, please refer to Appendix I.

4.2.3. Exposure to financial-themed ads

Secondly, various video ads were curated from the Meta Ad Library and TikTok Creative Centre to analyze whether participants from lower economic backgrounds are targeted with ads that exploit their social disadvantage. These selections were made by filtering authentic ads delivered within the surveyed country and aligning them with its predominant language. Following each video, participants were prompted to rate, on a scale of 1 to 5, their perceived likelihood of encountering a similar ad on their social media feeds, with 1 signifying "not at all likely" and 5 indicating "very likely." Participants were exposed to 15 ads with an average duration of 22 seconds, including 6 control ads and 9 ads focused on economic improvement and lifestyle enhancement, referred to in this study as financial-themed ads. The control ads showcased various products and services, including food and beverages, nutritional supplements, dental solutions, and fashionable items like shoes and watches.

The financial-themed ads promised financial prosperity, career advancement, or lifestyle enhancement through products and services such as entrepreneurial venture courses, job opportunities, loans, and financial investment apps. The selected ads were social media native productions without brand identification. Ads targeting niche audiences and containing seasonal references were avoided to prevent response bias. For ads aimed at a specific gender, a corresponding ad targeting the opposite gender was chosen. Non-binary participants and those who did not disclose their gender were alternately shown ads featuring either male or female protagonists. Ads promoting adult content platforms, vaping products, or alcoholic beverages were excluded to avoid potential risks or offenses. Minors did not participate in this part of the survey due to the new Digital Services Act (DSA, Art. 28), which prohibits platforms from showing minor-targeted ads based on profiling (European Commission, 2023). A comprehensive transcription of the video ads shown to participants can be found in Appendix I.

5. Result

5.1. Types of advertising exposure regarding socioeconomic status

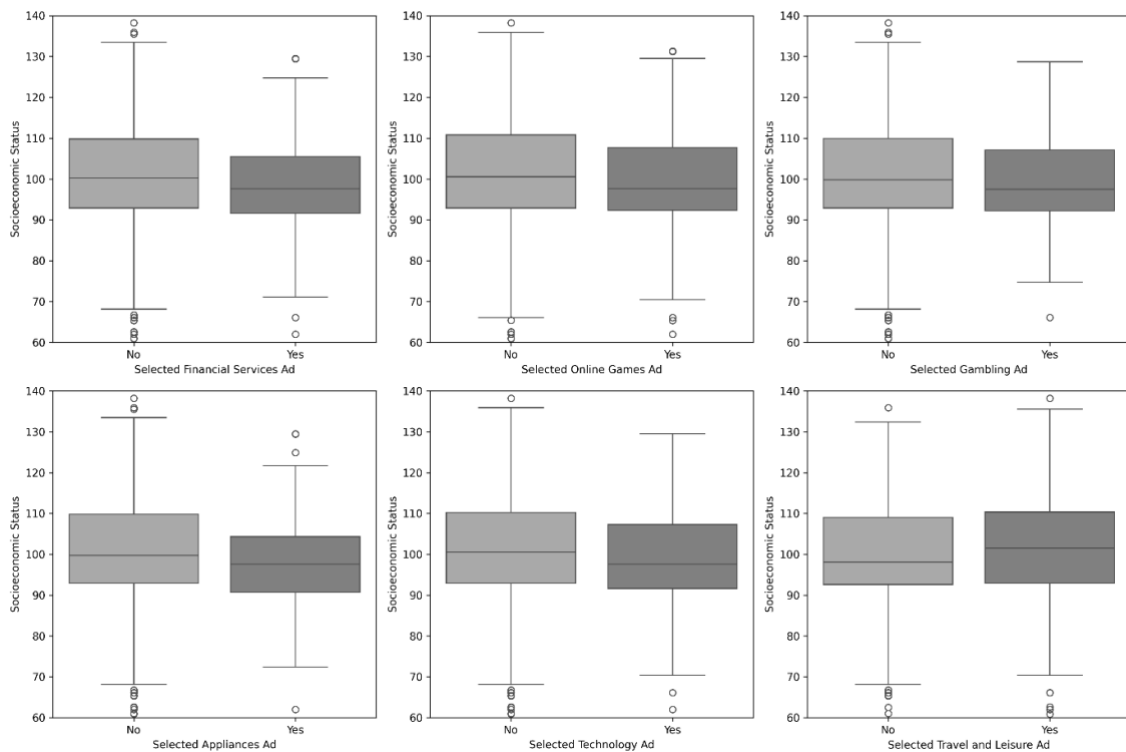
A Pearson correlation analysis reveals a relationship between socioeconomic situation and exposure to specific ad topics. At lower socioeconomic levels, participants exhibited higher

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exposure to ads for financial services (banks, loans, and investments), $r(1198) = -.077, p = .008$; online games, $r(1198) = -.097, p < .001$; gambling, $r(1198) = -.078, p < .007$; appliances, $r(1198) = -.066, p = .023$; and technology, $r(1198) = -.086, p = .003$, as illustrated in Figure 1.

Conversely, higher socioeconomic levels correlated with increased exposure to ads for travel and leisure, $r(1198) = .068, p = .018$ (see Figure 1). No significant relationship was found between socioeconomic status and exposure to advertisements across various topics, including fashion, beauty, health, fitness, dating, diet, sports, electronic cigarettes, alcohol, energy drinks, food delivery, education, parenting, household products, news and entertainment, and pets. Therefore, H1 was partially confirmed, as socioeconomic status influences exposure to several personalized ads, but not all of them.

Figure 1. Socioeconomic status distribution by ad selection across categories

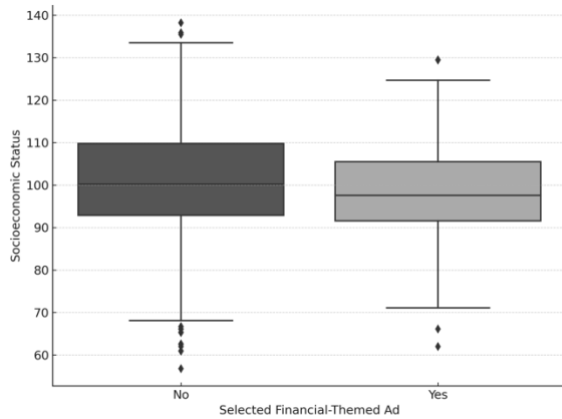


Source: Own elaboration.

5.2. Exposure to financial-themed ads regarding socioeconomic status

A second Pearson correlation analysis was conducted, averaging the responses across the nine financial-themed ads. The topics included becoming an entrepreneur, securing well-paid flexible work, pursuing a career in modeling, opting to be a civil servant, earning income through social media platforms, working remotely, investing in cryptocurrencies, and seeking a loan. Findings reveal a statistically significant association between socioeconomic status and exposure to financial-themed ads, $r(1171) = -.090, p = .002$. Therefore, H2 is confirmed as individuals from lower socioeconomic backgrounds are more likely to receive ads related to these topics (see Figure 2).

Figure 2. Socioeconomic status distribution by selection of financial-themed ads



Source: Own elaboration.

5.3. The intersection of socioeconomic status and gender on ad exposure

To examine how gender and socioeconomic position predict the results above and answer RQ1, a multiple regression analysis was conducted. Non-binary cases were omitted in this analysis, and gender was treated as a dichotomous variable (dummy variable, where male participants were coded 1 and female participants were coded 2), given the small proportion of individuals who either declined to disclose their gender or identified as non-binary (3.29%).

The analysis confirmed that both gender and socioeconomic status significantly predict exposure to advertisements for financial services (such as banks, loans, and investments), online games, gambling, and technology, which aligns with the results of the correlations (see Table 1). Notably, socioeconomic position alone predicts exposure to appliance ads ($\beta = -.070, p = .016$), while gender exclusively predicts exposure to travel and leisure ads ($\beta = -.154, p < .001$).

Table 1. Types of ads correlated with socioeconomic level and gender

	Finances	Online Games	Gambling	Tech
	β	β	β	β
Class	-.074	-.087	-.074	-.078
Gender	-.084	-.228	-.197	-.194
F (gl)	7.83 (2, 1166)	38.58 (2, 1166)	28.26 (2, 1166)	27.96 (2, 1166)
p	<.001	<.001	<.001	<.001
R (Adjusted R^a)	.115 (.013)	.249 (.062)	.215 (.046)	.214 (.046)

Note. Gender was coded as a dummy variable with 1 = men and 2 = women.

Source: Own elaboration.

Additionally, gender was a significant predictor across most categories (see Table 2), except for dating, health, diet, electronic cigarettes, news and entertainment, NGOs, and religion, where neither gender nor socioeconomic situation had a significant effect. Men are more likely to encounter ads related to sports, alcohol, energy drinks, cars, and politics, while women are more exposed to advertisements for fashion, beauty, fitness, food delivery, education, parenting, household products, pets, and travel and leisure.

Table 2. Types of ads correlated with gender

	Fashion	Beauty	Fitness	Sport
	β	β	β	β
Class	.025	.006	.032	.047
Gender	.299	.402	-.199	-.274
<i>F (gl)</i>	58.32 (2, 1166)	112.48 (2, 1166)	24.15 (2, 1166)	47.92 (2, 1166)
<i>p</i>	<.001	<.001	<.001	<.001
<i>R (Adjusted R^a)</i>	.302 (.091)	.203 (.011)	.199 (.040)	.276 (.076)

	Alcohol	Energy drinks	Food delivery	Education
	β	β	β	β
Class	.012	-.030	.020	.036
Gender	-.012	-.118	.068	.078
<i>F (gl)</i>	10.36 (2, 1166)	9.03 (2, 1166)	3.02 (2, 1166)	4.52 (2, 1166)
<i>p</i>	<.001	<.001	.049	.011
<i>R (Adjusted R^a)</i>	.132 (.017)	.124 (.015)	.072 (.005)	.088 (.008)

	Parenting	Household products	Pets	Travel & Leisure
	β	β	β	β
Class	-.049	-.043	-.004	.053
Gender	.156	.106	.104	.154
<i>F (gl)</i>	15.46 (2, 1166)	7.44 (2, 1166)	6.31 (2, 1166)	16.59 (2, 1166)
<i>p</i>	<.001	<.001	.002	<.001
<i>R (Adjusted R^a)</i>	.161 (.026)	.112 (.013)	.103 (.011)	.166 (.028)

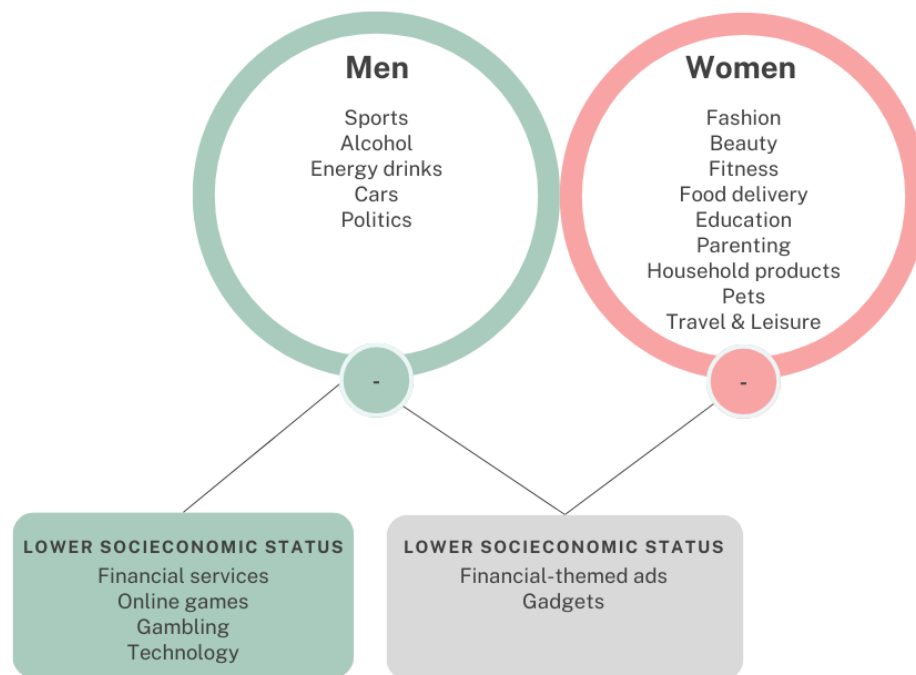
	Cars	Politics
	β	β
Class	-.001	-.012
Gender	-.160	-.076
<i>F (gl)</i>	15.27 (2, 1166)	3.50 (2, 1166)
<i>p</i>	<.001	.031
<i>R (Adjusted R^a)</i>	.160 (.026)	.077 (.006)

Note. Gender was coded as a dummy variable with 1 = men and 2 = women.

Source: Own elaboration.

Finally, another regression analysis examined the predictors of exposure to the nine financial-themed ads. The results revealed that the predictors collectively explained 0.9% of the variance, $F(2, 1143) = 6.17$, $p < .002$. Notably, only socioeconomic situation emerged as a significant predictor of exposure to such a group of ads ($\beta = -.103$, $p < .001$), while gender did not demonstrate a significant predictive relationship ($\beta = .020$, $p = .487$).

Figure 3. Summary of results: types of ads and their correlation with gender and socioeconomic level



Note. Pearson correlation shows that participants from lower socioeconomic levels have greater exposure to financial services, online games, gambling, and technology ads, while those from higher socioeconomic levels are associated with travel and leisure ads. However, multiple regression analysis reveals that gender is the sole predictor for travel and leisure ads and also significantly influences exposure in the other categories.

Source: Own elaboration.

6. Discussion

Numerous studies have examined disparities in exposure to traditional advertising among vulnerable population groups, particularly ethnic minorities and lower socioeconomic classes. These investigations in the public health field aimed to clarify why socioeconomically disadvantaged groups tend to exhibit higher rates of obesity, smoking, and alcoholism. After analyzing and comparing outdoor advertising and ads in magazines and on television channels, most studies concluded that people in disadvantaged situations are more likely to see ads for unhealthy products, and this trend extends to minors (see, for example, Adams et al., 2011; Adams & White, 2009; Agaku et al., 2013; Backholer et al., 2020; Cassidy et al., 2015; Olsen et al., 2021; Powell et al., 2007).

The World Health Organization (WHO) repeatedly warns that despite existing policies, minors and adolescents are still regularly exposed to digital advertising for many unhealthy products, such as alcoholic beverages, foods with high content of saturated fats, salt, and free sugars (HFSS foods), and tobacco or electronic cigarettes. The organization insists on the need to monitor exposure to online advertising from a class perspective, given the evidence that socioeconomic variables play a role (WHO 2018; 2024).

Although our research did not initially consider those products to which European legislation applies advertising restrictions (Suárez-Alvarez & Pastor-Rodríguez, 2023), we have

alarmingly found that minors (n=47) have also selected electronic cigarettes (n=4), alcohol (n=3), energy drinks (n=2) and gambling (n=6) among the ads that appear on their social media.

On the other hand, we have not found a significant connection between exposure to advertisements for unhealthy products and socioeconomic status, as observed in traditional advertising. Conversely, we did identify gender differences. Our results indicate that men are more likely than women to encounter advertisements for alcohol and energy drinks, which corresponds with the fact that most current consumers of these products in Spain are men (INE, 2024; OEDA, 2023). Regarding electronic cigarettes, there was no notable gender difference, which may be linked to the smaller gap between male and female smokers (INE, 2024).

Overall, our findings reaffirm theories that algorithms reproduce gender biases (Dalenberg, 2018; Singh et al., 2020; Rathee et al., 2023). According to our results, women are more likely to encounter ads for fashion, beauty, parenting, fitness, and home products, while men are likelier to see ads for automotive and sports. In other categories, differences arise that are not easily explained by classic stereotypes but are nonetheless concerning: men are more exposed to political advertising, while women are more likely to see ads for education, pets, travel, and leisure.

Regarding discrimination based on socioeconomic status, our study offers a comprehensive view of socioeconomic position. We have taken a unique approach to measuring socioeconomics by employing a synthetic index that incorporates various factors such as education, income, migration background, and employment. Consequently, our findings provide further insights into Bol et al.'s (2020) study, which explored how different demographic groups interacted with diverse brand content on Facebook.

We both identified some similarities in gender exposure differences. However, while their results indicated that individuals with lower educational levels were more likely to encounter branded content related to entertainment, our study finds no correlation between entertainment and socioeconomic status. Additionally, although they did not find a significant impact of income on exposure to branded content, our main findings reveal that socioeconomic status is crucial for exposure to ads delivered by algorithms.

More concretely, young people from lower socioeconomic backgrounds are more likely to encounter ads about easy passive income, life changes with minimal effort, and quick earnings than their more affluent peers. Moreover, belonging to a lower socioeconomic background and being male are strong predictors of receiving ads for financial services such as loans or investments, gambling, and online games.

Our results highlight how algorithms categorize individuals by inferring detailed and complex information such as their employment categories, education level, immigration status, and income. This profiling is then utilized to target advertisements promoting benefits like free clothing, permanent high-paying jobs, earning money through social media, interest-free purchases, remote work with attractive salaries, and the notion that anyone can easily achieve financial success without prior experience or knowledge.

The reasons for this discrimination are complex to discern. On one hand, it could involve intentional discrimination by advertisers utilizing the platforms' segmentation options. Platforms like TikTok and Instagram enable advertisers to select audiences based on demographic information such as gender, age group, language, or location, as well as more specific data like users' interests, the operating systems they use, or the price of their devices. Advertisers can also provide prior audience data to exclude certain groups from seeing the ad or to find similar ones. Thus, the first step toward discrimination can happen when advertisers select or exclude the audience they wish to target, which is facilitated by the platform's options.

However, several studies have investigated how algorithms optimize campaigns when advertisers target broad audiences and aim to avoid discrimination (Ali, 2021). These studies, analyzing Facebook, conclude that the algorithms discriminate in the optimization process despite using neutral targeting parameters. Ali et al. (2019) identified discrimination based on gender and race for employment and housing opportunities. Lambrecht and Tucker (2019) found that women were less likely to be shown ads for STEM jobs. More recently, Global Witness (2021; 2023) conducted research in several countries and confirmed that, despite the corrective measures recently taken by the platform in some areas, Facebook's ad delivery algorithms still exhibit gender bias. The platform displayed traditionally female jobs, such as daycare nursing, to women and historically male jobs, such as mechanics, to men.

As a last resort, the inequality in ad viewing may be due to how advertising auctions work. Advertisers compete with each other to have their ads appear, and some audiences are more expensive to reach because they perform better or are in demand. In low-budget campaigns, algorithms try to be more efficient and economical and might avoid these audiences. In other words, some audiences are cheaper to reach and could be overrepresented in low-budget campaigns (Ali et al., 2019; Lambrecht & Tucker, 2019).

Advertising has traditionally played an essential role in promoting inequalities and perpetuating stereotypes. However, there are significant differences between discrimination in traditional advertising and current discrimination based on algorithmic processes. While in conventional advertising, individuals can encounter advertising diversity by consuming different media types or walking from one neighborhood to another; personalized advertising is framed in the private sphere, limiting individuals' ability to discern and choose. From a research point of view, analyzing traditional advertising is possible to the extent that it is accessible. Auditing the content and audience of algorithmically delivered advertising is highly complex and ethically sensitive (Backholer et al., 2020).

7. Conclusions

This study reveals that socioeconomic status and gender significantly influence the type of algorithmically distributed ads young people receive, reinforcing social and gender inequalities (see Figure 3). While personalized advertising claims to enhance the user experience by showing ads of interest and avoiding less relevant ones (Instagram, n.d.; TikTok, n.d.), our findings highlight other unintended consequences of personalization.

TikTok and Instagram collect extensive amounts of user data, including personal information, browsing activity, and location. TikTok excels at analyzing unpublished content like drafts and comments, and it extracts biometric data such as faceprints, voiceprints, and object recognition from user-generated content. Meta-owned Instagram, meanwhile, focuses on cross-platform data integration with Facebook and other services from the tech giant (Clario, 2022).

Both platforms share data with advertisers and partners to enhance targeted advertising. Our findings indicate that this data can be used to infer complex realities, such as socioeconomic status, and that it is utilized for commercial purposes, reinforcing social inequalities.

The partial confirmation of our first hypothesis offers critical insights: while socioeconomic position does not influence exposure to all ad categories, it does significantly affect exposure to ads tied to promises of earnings and economic opportunities, such as financial services (banks, loans, and investments), gambling, and online gaming, which are disproportionately targeted at disadvantaged young people. Similarly, our second hypothesis was confirmed: content promoting financial success through quick or unrealistic means, including entrepreneurship courses, high-paying job promises, social media income,

cryptocurrency investments, and fast loans, is more frequently directed at individuals with lower socioeconomic status.

These findings highlight the ways in which hyper-surveillance and extensive data collection are used to exploit vulnerabilities. This ultimately serves the interests of advertisers and platforms that rely on advertising revenue while exacerbating existing power imbalances.

Our findings also provide valuable insights into how gender and socioeconomic status interact to shape exposure to highly personalized ads. Specifically, lower socioeconomic status males are more likely to encounter ads for financial services, online games, gambling, and technology. In contrast, lower socioeconomic status females do not exhibit a similar pattern; their exposure is shaped by gender rather than socioeconomic position. This suggests that gender influences exposure independently of socioeconomic status for women, while for men, the two factors combine to produce additional inequalities.

These findings can be understood through the framework of intersectionality, which emphasizes how overlapping systems of privilege and oppression shape experiences differently based on identity. In this case, being a man from a higher socioeconomic class seems to mitigate exposure to specific ads, such as those related to financial themes, online gaming, and gambling, reflecting how privilege can shield individuals from certain types of targeting. However, being a woman, even from a higher socioeconomic background, does not offer the same level of protection. Instead, women continue to face targeted advertising shaped by gender stereotypes, with ads focused on fashion, beauty, parenting, and home-related products. This underscores how the intersection of gender and class creates distinct patterns of exposure for men and women, reinforcing the necessity of considering both factors in understanding the dynamics of algorithmic advertising.

It is crucial not to underestimate the impact of algorithmic and machine learning systems employed by AdTech companies to personalize advertisements, whether by determining who sees an ad or by selecting which ad version will be most effective for a particular individual. Advertising underpins today's internet's economic model, making it ubiquitous and influential in shaping digital experiences.

While much attention has been given to areas where algorithmic systems directly affect individual rights, such as access to government benefits or criminalization, the pervasive role of personalized advertising warrants closer scrutiny, its omnipresence amplifies its potential to reinforce existing inequalities and biases, impacting not only consumer behavior but also broader societal dynamics.

Ultimately, our study underscores the urgent need to critically evaluate not only algorithmically personalized advertising but also the broader systems of recommendation and machine learning that increasingly influence every sphere of life—whether for entertainment, commercial purposes, or beyond. These systems, while enhancing user experiences, also profoundly shape power dynamics and societal structures. Our findings reveal that even when legislation prohibits the collection of sensitive personal data, such information can be easily inferred through the vast amount of data collected opaquely, raising significant concerns about the social implications of profiling at scale. This process risks reinforcing existing inequalities and perpetuating systemic biases, especially as data collection continues to expand in a world that is becoming ever more digitalized and meticulously tracked. Furthermore, intersectionality is critical to understanding these dynamics, as our results demonstrate how profiling interacts with overlapping dimensions of identity, such as socioeconomic status and gender, to produce distinct patterns of discrimination.

While European legislation, such as the General Data Protection Regulation (GDPR) and the Digital Services Act, aims to empower users regarding their data and places barriers on data-driven advertising (e.g., stricter limits for minors and mandates for greater transparency), it fails to mitigate the collateral effects of profiling and hyper-personalization fully. As our findings and prior research (Sáez-Linero et al., 2025) indicate, even the proposed alternative of promoting paid subscription-based versions of digital services may not be well-received or fully understood by younger users, potentially leaving them vulnerable to the same risks.

AdTech companies play a central role in this ecosystem, underpinning most free online services, including social media platforms. The growing dominance of these companies emphasizes the need for rigorous scrutiny of their practices, given their pervasive impact on everyday life. Addressing these challenges requires not only stronger regulatory frameworks but also greater public awareness and a commitment to ethical innovation. Without this, the unbridled expansion of data collection and profiling risks deepening social divisions, entrenching power imbalances, and eroding trust in the digital systems that have become integral to modern life. Moreover, these technologies also have the potential to achieve the opposite, promoting equity and inclusion when designed carefully and applied ethically.

8. Limitations and future research

This study examines whether individuals' socioeconomic situations can predict their exposure to persuasive messages that exploit their economic vulnerabilities. While the findings provide valuable insights, it is important to acknowledge its limitations.

Firstly, the survey depended on participants' recall and perceptions, making it vulnerable to biases like social desirability. Utilizing more advanced methods, such as data donation, would enable researchers to collect more comprehensive insights. These methods could also help identify patterns of exposure that remain hidden in self-reported data.

Secondly, while global inequality between countries has decreased over the past quarter-century, income inequality within countries has increased (World Inequality Lab, 2022). Intersecting factors such as age, ethnicity, origin, disability, sexual orientation, and religion further exacerbate this inequality, creating unique vulnerabilities. Future studies should incorporate these intersectional dimensions to better understand how personalization and profiling systems might reinforce or amplify these inequalities. Additionally, due to their low representation in the sample, non-binary individuals were not considered in the analyses, an omission that future research should address.

The increasing reliance on data-driven systems and personalized messaging poses a significant challenge. While these technologies hold the potential to improve societal outcomes, they often disproportionately affect disadvantaged groups, exposing them to more harmful or exploitative practices. As the volume and granularity of data increase, it is critical to ensure that these advancements do not deepen existing inequalities.

In conclusion, future research must prioritize the development of robust methodologies to measure exposure to persuasive content while considering the impact of socioeconomic and intersectional factors. Expanding the focus to include more diverse populations and adopting an intersectional lens will be crucial for capturing the multifaceted nature of inequality in digital environments.

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Annex

Appendix I is the full questionnaire used in a study on young people's understanding of personalized advertising on social media. It is available in the Figshare data repository with the following doi: <https://doi.org/10.6084/m9.figshare.28869464.v1>