

Age Differences in the Effectiveness of Personality-Tailored Advertising on Social Networks: Evidence from Croatia

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Abstract. *This study examines whether the effectiveness of personality-tailored social media advertising differs by age among Facebook users in Croatia. Two seven-day quasi-experimental Facebook campaigns promoted Shopaj24, a nationwide digital classified-advertising platform, and a dental clinic serving Zagreb. Adults aged 18 and older were segmented only using Facebook Likes associated with Big Five personality traits (Likes-user matrix) and shown either trait-congruent or non-congruent visual advertisements, with copy and nominal budget held constant. Across both campaigns, 156,127 impressions reached 102,377 users. Advertising effectiveness was assessed using click-through rates and click/non-click frequencies across three age groups (18–34, 35–54, and 55+). Age-related differences were most consistent for Extraversion and Neuroticism. The findings suggest that age can refine personality-based targeting, although effects vary by service context and personality trait.*

Keywords. Digital advertising, personality-tailored advertising, Big Five, age differences, Facebook, Croatia.

1 Introduction

Personalisation is a central advantage of digital advertising because persuasive messages tend to be more effective when they align with recipients' motives, identities, and psychological characteristics (Hirsh, Kang, and Bodenhausen, 2012; Matz et al., 2017). Age is also relevant to responses to advertising. Recent research indicates that advertising effectiveness, message preference, memory, and purchase-related judgments differ across age groups and that these differences depend on the type of appeal and product context (van der Goot, Bol and van Weert,

2021; Mecredy, Stocchi and Feetham, 2025; Chen et al., 2025). Earlier work similarly linked age to shifts in motivational priorities, information processing, and responses to emotional appeals (Williams & Drolet, 2005; Carpenter & Yoon, 2011). Age is also associated with systematic mean-level differences in Big Five traits across adulthood (Soto et al., 2011). Consequently, age may be associated with differences in responses to personality-congruent cues.

Personality has been associated with purchase intentions, browsing behaviour, and the likelihood of interacting with an advertisement (Hirsh, Kang and Bodenhausen, 2012; Matz et al., 2017; Azucar, Marengo and Settanni, 2018). However, psychological-targeting research has mainly examined whether trait-congruent messages outperform non-congruent messages, while paying less attention to whether this advantage varies across age groups. This gap is important because age-related motivational and processing differences may strengthen, weaken, or reverse the effect of the same personality-tailored cue across consumer contexts.

The primary aim of this study was to examine whether responses to personality-tailored Facebook advertisements differed across age groups among Croatian users. A second aim was to determine whether the direction of these age differences was consistent across two contrasting service contexts - a nationwide digital classified-advertising platform and a local dental clinic - and across the Big Five trait segments inferred from Facebook Likes. Accordingly, the study asked whether age was associated with the incremental effectiveness of trait-congruent versus non-congruent visual advertising.

2 Previous research

2.1. Personalisation in digital advertising

Even though users' data are available, advertising today still operates under the mass communication model, leading to an increasing demand for interactivity and personalisation (Jurković, 2021; Statista, 2025). Bašić and Đurđević (2017) point out that because the average person is exposed to 600-625 advertisements every day, things have to change. So companies have to increase their advertising budgets to adapt to changing market conditions and quickly target consumers. In her research, Sačer (2022) shows that the visual characteristics of images correlate with users' personality traits. This aligns with Matz et al. (2019) and underscores the importance of appearance and aesthetics in advertising campaigns. Utilising users' individual preferences for specific visual elements improves the visual effectiveness of these campaigns.

2.2. The influence of age and personality traits on advertising perception

Age is related to both consumer decision-making and personality development across adulthood. Studies of the Big Five show systematic age-related mean-level differences and changes in trait stability (Soto et al., 2011; Cobb-Clark & Schurer, 2012; Wagner, Lüdtko and Robitzsch, 2019; Shchebetenko et al., 2020). Advertising research likewise indicates that responses to persuasive appeals, advertising memory, and broader indicators of advertising effectiveness can differ across age groups (van der Goot, Bol and van Weert, 2021; Mecredy, Stocchi and Feetham, 2025; Chen et al., 2025).

Importantly, age effects are not uniform. Recent studies show that they depend on the type of appeal, the product or service category, personal relevance, and the decision context (van der Goot, Bol, and van Weert, 2021; Chen et al., 2025). This context dependence provides a rationale for testing age across multiple advertised services rather than assuming a single general age effect.

Personality is also relevant to the reception of advertising. Trait-congruent messages have been shown to produce higher engagement than non-congruent messages, particularly for Extraversion and Openness (Hirsh, Kang, and Bodenhausen, 2012; Matz et al., 2017). Sačer (2023) extended this approach in Croatia by identifying Facebook Likes associated with Big Five dimensions, while Sačer (2022) validated visual materials linked to these traits. Combining age- and personality-based segmentation therefore provides a theoretically plausible test of whether psychological targeting effects differ across adulthood.

2.3. Effectiveness of online advertising

Click-through rate (CTR) is one of the most commonly used measures of online advertising success. It is defined as the ratio of advertisement clicks to impressions (Ružić, Biloš, and Turkalj, 2014). The average CTR for Facebook campaigns is 1,11%, but it varies by sector (from 0,47% for employment to 1,61% for legal services) (Chaffey, 2024).

Global spending on social media advertising is expected to reach 480 billion USD by 2030 (Davies, 2026). A vast amount of users' data in the digital space enables marketers to segment messages with great precision at low cost, enabling almost personalised communication. According to Bivens and Haimson (2016), cookies can be used by marketers to deepen and broaden data collection, helping them track users' online behaviour and enabling more targeted advertising.

2.4. Facebook Likes as one of the most powerful digital footprints of users

Every search history, social interaction, purchase, and other Internet activity is logged and can be transformed into Big Data (i.e., large datasets). This amount of data (thousands or even millions of users) and information can help scientists observe phenomena globally, not just in small datasets. In this way, they can reduce or even overcome the "noise" problem in the samples (Kosinski et al., 2016; Stachl et al., 2020). Kosinski, Stillwell and Graepel (2013) made a breakthrough in research using Big Data - specifically Facebook Likes. Only 30 Facebook Likes are enough to predict age with 60% accuracy, gender with 75% accuracy and Openness to new experiences with 30% accuracy. These findings raise important privacy concerns because it is proven that the average user during their Facebook use selects about 227 Likes, and that algorithm can judge a person's personality traits more accurately (with 280 Likes) than a spouse or than a friend (using just 65 Likes) (Youyou, Kosinski and Stillwell, 2015). This is not an isolated case; in her research, Sačer (2023) confirmed the results of Kosinski, Stillwell, and Graepel (2013); Youyou, Kosinski, and Stillwell (2015); and Kosinski (2014) for Croatian users. This research used the 50-item International Personality Item Pool (IPIP-50). It is a widely used instrument for measuring personality traits (Matz et al., 2017; Sačer, 2022; Matz et al., 2019; Youyou, Kosinski and Stillwell, 2015; Kosinski, 2014). Users' IPIP-50 scores were matched to their Facebook Likes, resulting in a User-Like matrix specific to Croatia. The same matrix was used in this research to segment Croatian Facebook users into groups based on their OCEAN scores.

3 Research design and methodology

Previous studies have demonstrated that trait-congruent appeals can improve advertising responses, but little is known about whether this effect varies across age groups. The present research therefore used a two-stage field quasi-experimental design. First, congruent and non-congruent creatives were compared within each campaign and trait segment. Second, age-related differences were examined for the trait-campaign combinations retained from the first stage.

H1: The effectiveness of personality-congruent advertising differs across age groups.

Facebook was selected because its advertising platform permits real-world targeting by age, location, and interests, making it suitable for a field test of psychological targeting comparable to earlier digital-persuasion research (Matz et al., 2017). Campaigns were implemented in Meta Ads Manager. The design was quasi-experimental because exposure occurred in the natural platform environment and ad delivery was optimised by the platform rather than assigned under full researcher control.

Psychographic audience segments were defined using the previously validated Croatian User-Like matrix (Sačer, 2023), which links Facebook Likes and interests to the Big Five traits. Only Likes in the highest 10% of trait associations that were available in Meta Ads Manager were used. Segment membership therefore indicated an inferred affinity with a trait; it was not a direct personality score obtained from a self-report inventory. Because Meta combines multiple selected interests with OR logic, an individual could enter a segment through one qualifying interest, and audience overlap across trait segments was possible.

All five Big Five dimensions were considered in the initial congruence analysis. The age analysis focused on the trait-campaign combinations that showed a congruence effect in that screening stage: Conscientiousness, Extraversion, and Neuroticism for Shopaj24, and Openness, Extraversion, and Neuroticism for the dental clinic. Agreeableness was not retained for either campaign. Because this selection was data-dependent, the age analyses should be interpreted as exploratory.

Two service contexts were used to assess whether age-related patterns were consistent across contrasting field settings. Shopaj24 was a nationwide digital classified advertising service, whereas the dental clinic was a geographically restricted health service in Zagreb. The comparison was not intended to represent the retail and health sectors as a whole; rather, it served as an exploratory cross-context test. Visual materials were drawn from a previously validated Croatian image set, in which each image was empirically associated with a Big Five trait (Sačer, 2022).

Each campaign ran for seven days. Within each retained trait segment, users were exposed to either a trait-congruent image or a non-congruent control

image. Written copy was identical across services, and each ad set received the same nominal budget of EUR 15. Meta's delivery algorithm distributed impressions within those constraints. Thus, the manipulated element was visual trait congruence, while copy and nominal budget were held constant.

In total, the campaigns reached 102,377 Facebook users in Croatia (Shopaj24: 64,951; dental clinic: 37,426) and generated 156,127 impressions (Shopaj24: 102,764; dental clinic: 53,363).

The target population comprised adults aged 18 years or older residing in Croatia; the dental-clinic campaign was restricted to residents of Zagreb. For each retained trait segment, the campaign included a congruent and a non-congruent creative condition. No self-report personality inventory was administered, and the audience definitions were based exclusively on Facebook Likes included in the Croatian User-Like matrix.

Figure 1 shows an example of a trait-congruent creative for users with an inferred affinity for Openness. Meta Ads Manager did not make every Like in the Croatian matrix available for targeting; therefore, only eligible Likes were used. For example, 42 of the 165 Likes most strongly associated with Neuroticism were available in the platform.

In contrast to Matz et al. (2017), only the image was tailored to the inferred personality trait; the written copy remained unchanged within each service:

- Shopaj24: Shopping? The best offers are waiting for you on the new Shopaj24 platform. Discover them and see for yourself.
- Dental clinic: [FREE EXAMINATION] Perfect your smile. Schedule a free initial examination at a dental clinic with over 30 years of experience.

Meta Ads Manager combined selected Likes with the OR operator rather than requiring users to match all interests. Consequently, inclusion in a segment could be based on a single qualifying Like, and trait segments were not mutually exclusive. Table 1 reports the estimated audience sizes and the number of Likes available for each segment.

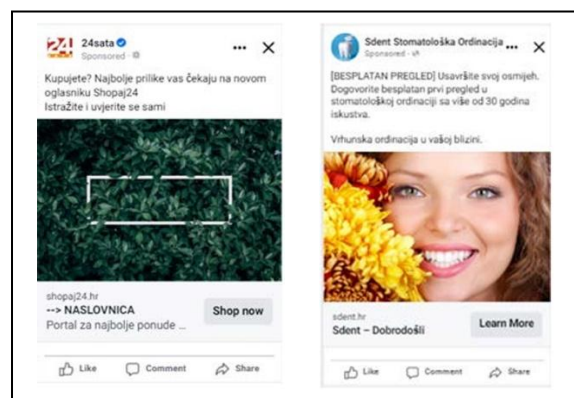


Figure 1. Example of a personality-trait-congruent advertisement for users with an inferred affinity for Openness

The methodological approach was chosen to extend prior field research on psychological targeting (Matz et al., 2017) while adapting the segmentation and visual stimuli to the Croatian context (Sačer, 2022; Sačer, 2023). Using two distinct service contexts provided an exploratory assessment of cross-context consistency. However, the absence of direct personality measurement and full random assignment limits claims to causal and construct validity.

Advertised service	Audience name	Estimated audience size	Num. of Likes
Shopaj24	Conscientiousness HR audience	1.900.000-2.200.000	46
	Extraversion HR audience	1.900.000-2.200.000	40
	Neuroticism HR audience	1.900.000-2.200.000	42
Dental clinic	Openness ZG audience	667.400-785.100	53
	Extraversion ZG audience	692.700-814.900	40
	Neuroticism ZG audience	686.100-807.200	42

Table 1. Audience segmentation based on Facebook Likes associated with Big Five traits

Note. Audience sizes are estimates generated by Meta Ads Manager from the specified target parameters.

Click-through rate (CTR; clicks divided by impressions multiplied by 100) was used as the descriptive indicator of campaign response. Inferential analyses were based on click and non-click frequencies rather than on CTR values themselves. For each retained trait-campaign combination, Pearson chi-square tests were used to compare response frequencies across the three age groups. Separate 2 x 2 chi-square tests then compared congruent and non-congruent creatives within each age group. Binary logistic regression was used to estimate differences in click probability across age groups, with ages 18-34 as the reference category. Models were fitted separately for each retained trait-campaign combination, and statistical significance was evaluated at $p < .05$.

Meta Ads Manager reports several narrower age bands (18-24, 25-34, 35-44, 45-54, 55-64, and 65+). For the present analyses, these categories were combined into three broader groups: younger adults (18-34), middle-aged adults (35-54), and older adults (55+). The grouping supported interpretable cross-campaign comparisons and reduced fragmentation of the response-frequency tables.

Age-related analyses were conducted separately for each retained campaign-trait combination. Because retention depended on the first-stage congruence

results and several subgroup tests were conducted, the findings are considered exploratory.

4 Research results

CTR values are reported descriptively, whereas the chi-square tests were calculated from click and non-click frequencies. The analyses therefore assessed whether response frequencies differed across age groups and whether congruent creatives outperformed non-congruent creatives within each age group.

For the dental-clinic campaign, age was associated with response in the Neuroticism segment, $\chi^2(2) = 8.483$, $p < .05$, whereas the corresponding age-group tests were not significant for Extraversion or Openness. Among users exposed to Neuroticism-congruent advertising, CTR was 5.5% for ages 18-34, 3.7% for ages 35-54, and 3.0% for ages 55+.

Within each dental-clinic age group, Neuroticism-congruent and non-congruent creatives also differed significantly: ages 18-34, $\chi^2(1) = 9.412$, $p < .05$; ages 35-54, $\chi^2(1) = 15.698$, $p < .05$; and ages 55+, $\chi^2(1) = 10.673$, $p < .05$.

For Shopaj24, age-group differences were significant for Extraversion, $\chi^2(2) = 24.552$, $p < .05$, and Neuroticism, $\chi^2(2) = 55.154$, $p < .05$, but not for Conscientiousness, $\chi^2 = 3.009$, $p > .05$. Among users exposed to congruent creatives, CTR increased across age groups for Extraversion (3.0%, 3.5%, and 5.4%) and Neuroticism (4.5%, 5.2%, and 7.4%).

For Extraversion, congruent and non-congruent Shopaj24 creatives differed within ages 35-54, $\chi^2(1) = 14.674$, $p < .05$, and ages 55+, $\chi^2(1) = 24.326$, $p < .05$, but not within ages 18-34. For Neuroticism, the difference was significant within all three age groups: ages 18-34, $\chi^2(1) = 29.074$; ages 35-54, $\chi^2(1) = 73.425$; and ages 55+, $\chi^2(1) = 169.077$, all $p < .05$.

The logistic regression models yielded the same directional pattern. In the dental-clinic Neuroticism segment, users aged 35-54 (AME = -0.0113 , SE = 0.0059 , 95% CI [-0.0229 , 0.0014], $p = 0.053$) and 55+ (AME = -0.0123 , SE = 0.0055 , 95% CI [-0.0231 , -0.0015], $p = 0.026$) showed lower click probability than users aged 18-34. In Shopaj24, users aged 55+ showed higher click probability than users aged 18-34 in the Extraversion (AME = 0.0119 , SE = 0.0030 , 95% CI [0.0060 , 0.0178], $p = 0.000$) and Neuroticism segments (AME = 0.0111 , SE = 0.0027 , 95% CI [0.0058 , 0.0164], $p = 0.000$).

Overall, H1 received partial support. Age was associated with response to personality-congruent advertising in several, but not all, trait-campaign combinations, and the direction of the association differed between the two service contexts.

Across all delivered impressions, CTR was 2.25% for the dental clinic (2.78% for congruent and 1.72% for non-congruent advertisements) and 3.38% for Shopaj24 (3.92% for congruent and 2.85% for non-congruent advertisements). These descriptive values

were above the cited industry benchmarks of 0.83% for healthcare and 1.59% for retail (Irvine, 2025); however, benchmark comparisons are descriptive and do not establish the causal effect of tailoring.

5 Conclusions and Recommendations

The findings indicate that personality-congruent visual advertisements can generate higher engagement than non-congruent advertisements, but the age pattern was conditional rather than uniform. In the dental-clinic campaign, the strongest age-related pattern was for Neuroticism, which favoured younger adults. In the Shopaj24 campaign, Extraversion- and Neuroticism-congruent advertisements produced higher response rates among older adults. Age should therefore be interpreted as a contextual refinement of personality-based targeting, not as a universally acting moderator.

This study makes three scientific contributions. First, it extends research on psychological targeting by examining age differences in a field setting rather than treating age solely as a control variable. Second, it applies the same trait-congruence logic in two distinct service contexts and uses observed click behaviour rather than stated intentions. Third, it provides evidence from Croatia using a locally validated User-Like matrix. Together, the findings show that age-related differences in personality-tailored advertising are conditional on both the trait cue and the advertised service.

From a practical perspective, age can serve as an additional layer in psychographic targeting. For health-related services, assurance, efficacy, and control cues may be relevant when targeting younger users with an inferred affinity for Neuroticism. For digital classified advertising services, socially and emotionally reassuring cues may be useful when targeting older users with inferred affinities for Extraversion or Neuroticism. Because the effects were context-specific, these implications require replication before being generalised to other campaigns or sectors.

Several limitations qualify the findings. Personality was inferred from Facebook Likes and was not measured directly. Meta's OR targeting logic allowed entry into the segment via a single qualifying interest and permitted overlap across trait segments. Ad delivery was optimised by Meta, so exposure was not fully randomised, and users could receive unequal numbers of impressions. Only visual elements were tailored, campaigns lasted seven days, and outcomes were limited to clicks rather than conversions or retention.

The two services were contrasting field contexts, not representative samples of the retail and health sectors, and the findings may not generalise beyond Croatian Facebook users or to other platforms. In addition, trait-campaign combinations were selected

based on first-stage congruence results, and numerous subgroup tests were conducted. The age analyses are therefore exploratory and may be affected by selection and multiplicity.

Future studies should preregister the primary contrasts, test age x congruence interactions directly, report regression coefficients and odds ratios with 95% confidence intervals, use direct personality measures where feasible, and include additional service categories and post-click outcomes. Such replications would clarify when age meaningfully enhances the effectiveness of personality-tailored digital advertising.

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