

# Identity Signals in Emoji do not Influence Perception of Factual Truth on Twitter

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## Abstract

Prior work has shown that Twitter users use skin-toned emoji as an act of self-representation to express their racial/ethnic identity. We test whether this signal of identity can influence readers' perceptions about the content of a post containing that signal. In a large scale (n=944) pre-registered controlled experiment, we manipulate the presence of skin-toned emoji and profile photos in a task where readers rate obscure trivia facts (presented as tweets) as true or false. Using a Bayesian statistical analysis, we find that neither emoji nor profile photo has an effect on how readers rate these facts. This result will be of some comfort to anyone concerned about the manipulation of online users through the crafting of fake profiles.

## Introduction

As the influence of social media grows, it becomes ever more important to understand factors contributing to the spread of misinformation and “fake news”, as well as how people's beliefs may be swayed online. In this paper, we investigate the role of author identity, as signalled through emoji. Can these identity signals influence the extent to which a reader accepts information as being true? The answer has important consequences not only for whether and how authors choose to signal their own identity, but also for studying the deliberate manipulation of identity signals in online content.

In this paper, we focus on the connection between identity signals and beliefs (rather than the behaviour that might result, such as retweeting). As the main identity signal of interest, we use skin-toned emoji, building on previous work showing that these are used as a form of self-representation (i.e., identity signalling) (Robertson, Magdy, and Goldwater 2018, 2020), and that readers make use of these signals to infer aspects of the author's identity (Robertson, Magdy, and Goldwater 2021). We hypothesise that identity signals in a tweet's emoji will affect the extent to which a reader believes the content of that tweet.

In a large scale (n=944) pre-registered controlled experiment, we manipulate identity signals in tweets containing trivia facts and measure the extent to which readers perceive those facts to be true or false. We find evidence against any effect on perceptions for either emoji or profile photo. Under

a Bayesian statistical analysis, our experimental data supports the null hypothesis over the alternative in all of our analyses. This result is consistent across all experimental conditions, for two groups of participants based on self-reported ethnicity, and persists following adjustments to the experiment to address possible confounding factors in its design. Although these findings did not support our hypothesis, we argue that skin-toned emoji not affecting online behaviour in the way we expected is actually a positive result in the context of online manipulation, misinformation and fake news.

## Background

Decades of sociology and linguistic research show that aspects of identity (i.e. socially meaningful categories such as gender, class, or ethnicity) can be signalled in many ways (Goffman 1959) and that these signals can influence our attitudes, perceptions, and behaviour towards a person (Campbell-Kibler 2010; Labov 1972). Language is an important signal of identity and can affect one person's beliefs about another, such as whether they are trustworthy or intelligent (Lambert et al. 1960). Identity signals can also affect behaviour: for example, using African American-sounding names on Uber resulted in increased wait times and more cancellations by drivers (Ge et al. 2016).

Emoji can also signal aspects of identity. For example, gender can be signalled consciously through choosing to use a male or female emoji (or neither) (Barbieri and Camacho-Collados 2018) or perhaps less consciously via the frequency of use of particular emoji such as 🍌 or 🍷 (Chen et al. 2018). Here, we focus on ethnic identity, as signalled by skin-tone modifiers. Twitter users overwhelmingly use these to express their own identity (Robertson, Magdy, and Goldwater 2018), though referring to *other* people in specific situations has been observed (Robertson, Magdy, and Goldwater 2020). Expression of identity by authors is only one side of the story — readers of tweets containing light or dark toned emoji also associate authors with a congruent Black or White identity (Robertson, Magdy, and Goldwater 2021), and this association is separate from linguistic signals such as use of particular topics, phrases or syntax associated with Black or White speakers.

The connection between identity signals and behaviour has been studied in experimental economics, using the Trust Game. Pairs of anonymous players are designated sender and

Hyp.	Condition A	Condition B	Description	BF (Black)	BF (White)
H1a	No photo, no emoji	No photo, Black-aligned emoji	Sensitive to presence of emoji	0.109	0.443
H1b	No photo, no emoji	Black photo, no emoji	Sensitive to presence of photos	0.099	0.087
H1c	No photo, no emoji	No photo, White-aligned emoji	Sensitive to presence of emoji	0.186	0.073
H1d	No photo, no emoji	White photo, no emoji	Sensitive to presence of photos	0.834	0.142
H2a	No photo, matching emoji	No photo, non-matching emoji	Preference for identity-matching emoji	0.098	0.434
H2b	Matching photo, no emoji	Non-matching photo, no emoji	Preference for identity-matching photos	0.284	0.086
H3a	Matching photo, matching emoji	No photo, matching emoji	Emoji encode distinct identity signal	0.085	0.108
H3b	Matching photo, matching emoji	Matching photo, no emoji	Photos encode distinct identity signal	0.084	0.075

Table 1: Overview of hypotheses tested, in terms of photo/emoji conditions. These were tested separately for Black and White readers: matching/non-matching means that the skin tone of the emoji was aligned with the self-reported ethnicity of the reader. Final columns show Bayes Factors for t-tests and are discussed in the analysis/discussion section.

responder. The sender has a fixed amount of money and can keep the whole sum or send a portion to the responder. Any money sent this way will be tripled. The responder may keep everything they are sent, or return a portion back to the sender. Pairs play one round consisting of the sender making their decision, then the responder making their response. Buchan, Croson, and Solnick (2008) found an effect of gender on trust (as measured by the amounts sent/received), with women senders less likely overall to send money, but to send more to male responders than to female. Stanley et al. (2011) found a relation between the extent of a person’s racial bias (as measured through the Implicit Attitudes Test (IAT) (Greenwald et al. 2002)) and the extent to which they trust players of a different racial background.

More recently, Babin (2020) examined the effect of emoji when trust game players are allowed to communicate. Using emoji increased trust and reciprocity between players, but of particular relevance to our work here is the finding that use of skin-toned emoji may result in less trust when those skin tones are darker. Babin did not set out to evaluate the impact of skin tone and so this result must be regarded as preliminary. However, it motivates our work here as it is suggestive of skin-toned emoji being able to induce bias to the extent that behavioural outcomes are affected.

Our experimental setup is based on Lev-Ari and Keysar (2010), who looked at the effect of a speaker’s accent on how we react to what they say. Participants listened to speakers with native, mild foreign or strong foreign accents reading trivia facts such as “Ants never sleep”. On a scale from 0 to 100, participants rated statements from definitely false to definitely true. Accented statements were rated as less true even though participants were informed that the speakers were simply reciting statements written by the native-speaking experimenters. Lev-Ari and Keysar focused on processing difficulty as the explanatory factor for this outcome, rather than out-group or ethnic bias, but we would argue that the foreign accents used in the experiments are likely a highly salient indicator of race/ethnicity. To emulate the ‘reciting’ aspect, we can use retweets.

## Hypotheses

Before describing our experimental setup in detail, we will state the hypotheses it is intended to test and the rationale for these hypotheses. The experimental conditions arising from

these hypotheses are shown in Table 1.

First, we predict that the identity signal encoded in emoji (Robertson, Magdy, and Goldwater 2021) will have an effect on how readers evaluate trivia statements in terms of being true or false, similar to the findings of Lev-Ari and Keysar (2010). We also assume that a profile photo also encodes an identity signal.

Second, we predict that readers will be sensitive to the kind of identity encoded in emoji and photos. Readers may prefer their own identity (similar to in-group bias in favour of own gender (Rudman and Goodwin 2004)) or they may prefer another identity, for example if all users show a similar bias against a particular group (Valla et al. 2018).

Third, we predict the presence of both a photo and an emoji signal will have a larger effect than either one alone, as per Robertson, Magdy, and Goldwater (2021) who found a “boosting effect” of an emoji and a language signal of identity when users were asked to guess the identity of the author.

We test our hypotheses separately with Black and White participants (self-identified; see Participants section). This is primarily to ensure we do not mistakenly extend any effects found in one group to all groups, as prior work has shown differences in how Black and White social media users use and perceive skin-toned emoji in relation to expressions of identity (Robertson, Magdy, and Goldwater 2020, 2021).

## Experimental setup

Before proceeding, we acknowledge that some terms do not have universally agreed-upon definitions. Within the framework of Critical Race Theory (Ogbonnaya-Ogburu et al. 2020), race and ethnicity are socially constructed. As such, the meaning of these and related terms depends on context, audience and the user. We use Black and White in our work to denote the self-identified ethnic identity of the participants. For emoji, we use Black-aligned and White-aligned to denote emoji which prior research (Robertson, Magdy, and Goldwater 2018) shows to be preferred for self-representational usage by people of Black or White identities. Furthermore, we acknowledge that Black and White are not the only ethnicities which can be represented using emoji skin tones. However, we restrict our experimental setup to consider only these two options and make no claims as to how any findings may apply to other identities.

The experiment follows the setup of Lev-Ari and Keysar



Figure 1: Example of a critical trial from one block, showing manipulation of the identity encoded in profile photos and emoji.

(2010), with the main difference that it was conducted online. Participants were shown 31 tweets containing trivia and informed that the trivia could be true or false. Their task was to mark on a slider from 0 to 100 whether they thought the trivia was *definitely false* or *definitely true*. Participants were explicitly asked not to look up any trivia and informed that the correct answers would be shown upon completion of the study.

**Stimuli** Critical trials manipulated the identity signals present in emoji and photos, as shown in Figure 1. Emoji were either dark-toned (aligned with Black identities), light-toned (aligned with White identities) or absent. Only the downwards pointing finger 👇 was used. Photos signalled a probable Black identity, White identity or no obvious identity (e.g. a nature photo). There were 7 critical combinations of emoji/photo. Photos were female faces generated by StyleGAN<sup>1</sup>, to avoid using photos of real people, and blurred to obscure all detail except skin tone. In a pre-norming study, 25 Black and 25 White participants guessed the ethnicity of the blurred faces. We retained only those which the majority ( $\geq 95\%$ ) of participants considered to show a Black or a White person.

All trivia in the critical trials were true, but were likely to be neither well-known to be true nor generally thought (mistakenly) to be false. This was to prevent any ceiling effect in the ratings of the stimuli and was determined through a pre-norming study of trivia facts taken from Snapple soft drink lids.<sup>2</sup> 20 Black and 20 White participants rated 100 random facts as either true or false. We randomly sampled 7 from those facts where participants were at chance in deciding between true and false. Mean ratings for these facts were 47.5 (stdev 0.0932) for Black participants, 44.6 (stdev 0.0935) for White participants.

To control for any possible impact of individual facts on participant judgements, each of these facts appeared in each critical combination of emoji/photo. This was done in blocks, such that participants only saw each fact once in a single emoji/photo combination, but across the entire experiment

all critical facts were judged in all combinations.

Filler trials (to obscure the intent of the experiment) were balanced across two types of fact. Twelve were facts that pre-norming participants generally considered to be true/false (6 of each), and twelve were facts we created which were very obviously true or very obviously false (again, 6 of each). In addition, profile photos could be colourful and non-human (e.g. scenery) and blurred verified account ticks could be present in user names. Also, a wider range of emoji, including skin-toned ones, could appear in the main retweeter's text.

All stimuli were presented as a main user retweeting another account, with some comment expressing surprise or incredulity. Authentic-looking tweets were automatically generated from a copy of the Twitter HTML/CSS and saved as PNG files, to discourage participants looking for answers online by copying/pasting the text. The surprise/incredulity comments were selected based on a pre-norming study. 50 Black and 50 White participants provided three examples of how they would comment if sharing such a tweet. The most common responses shared between Black and White participants were chosen and sampled from at random.

Display names, user names, dates, number of likes/retweets/comments were all randomised before being blurred. In critical trials, the account being retweeted was always unverified and had a default grey display photo. In filler trials, these properties were randomly assigned. Finally, trials were presented in randomised order per participant. All stimuli can be found in our Open Science Framework pre-registration.<sup>3</sup>

**Participants** Participants were recruited through Prolific.co on the basis that they are native speakers of English, US citizens resident in the US and self-identified their ethnicity as either Black or White. We did not request or record any non-pertinent personal information (e.g. age, gender), in accordance with the University's data handling protocols. In all pre-norming and experimental tasks, participants were paid at a rate equivalent to the National Living Wage of £9.50 per hour. Approval for the study was obtained in advance from the University's ethics board. In total, 944 participants (472 Black, 472 White) were recruited for the main study, to ensure sufficient power to determine with a good degree of confidence whether our null or alternative hypothesis is true (using a Bayesian statistical analysis, described below). Power was determined using the SSDbain package in R (Fu, Hoijtink, and Moerbeek 2020).

## Analysis plan

The experiment generates a sequence of true/false ratings (from 0 to 100) per critical combination of emoji/photo. We analyse the means of these ratings for differences using a Bayesian two-tailed independent samples t-test (van Doorn et al. 2020), as implemented by the JASP<sup>4</sup> software package. The Bayesian t-test is parameterised by a prior distribution over our assumptions of the effect size. We follow standard

<sup>1</sup><https://github.com/NVlabs/stylegan>

<sup>2</sup>See <https://www.snapple.com/real-facts> for a full list

<sup>3</sup>See <https://osf.io/a8r6q/>

<sup>4</sup><https://jasp-stats.org/>

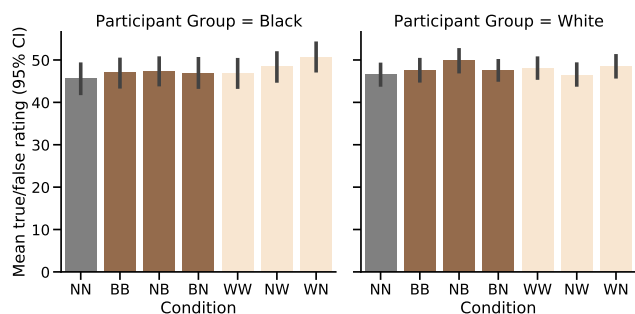


Figure 2: Mean true/false ratings (with 95% confidence intervals) per participant group. Each bar represents an experimental condition, with labels XY representing Emoji status (Black, White, No emoji) and Photo status (Black, White, No photo). Bars are coloured based on their prevalent identity signal (grey = no signal, brown = Black signal, beige = White signal)

practice of using a Cauchy prior with mean 0 and scale 0.707 (Quintana and Williams 2018).

We chose a Bayesian version of the t-test for comparing sample means as it allows us to report Bayes Factors rather than p-values, which means we can quantify the amount of support for or against our hypotheses, rather than simply testing whether the null hypothesis can be rejected (Rouder et al. 2009). The Bayes Factor (BF) is the ratio of the marginal likelihoods of two competing hypotheses ( $H_0$  and  $H_1$ ), given some observed data. Multiplying the prior odds of  $H_0$  and  $H_1$  (i.e. the ratio of  $P(H_0)$  to  $P(H_1)$ ) by the BF gives the posterior odds: the ratio of  $P(H_0|data)$  to  $P(H_1|data)$ . The BF quantifies the extent to which the observed data supports the hypotheses under consideration. For our purposes, the two competing hypotheses are no difference in means ( $H_0$ ) and a significant difference in means ( $H_1$ ). A BF value of 1 means the observed data supports each hypothesis equally well (i.e. it is uninformative), and normally indicates additional data is needed or hypotheses need to be reformulated. A BF value greater than 1 means there is more support for  $H_1$ , while a value less than 1 means more support for  $H_0$ .

## Results

Mean true/false ratings per experimental condition for each participant group are shown in Figure 2. The results of all analyses for both participant groups were in favour of  $H_0$  — there was no effect on the mean true/false ratings in any subsets of ratings selected for comparison. Table 1 reports the results of all t-tests in terms of Bayes Factor, from which it can be seen that experimental evidence offers between 1.2 and 13.4 times more support (i.e.  $1/BF$ ) for  $H_0$  in all cases than for the alternative hypothesis of a difference in mean true/false ratings. From this, we conclude that neither emoji nor profile photo, either alone or together, influence a reader's behaviour in the true/false trivia task.

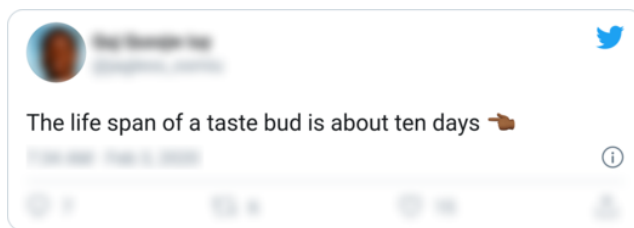


Figure 3: Example of a critical trial from one block, with the user directly tweeting the trivia, rather than retweeting another account.

## Further Analysis and Discussion

Although our experiments were motivated by a range of prior work, used carefully designed and normed stimuli, and involved almost 1000 participants, the evidence we found against any effect of identity signals prompted us to reflect on the experimental design and explore possible issues.

Did the presentation of the fact as a retweet of an account with no identity signals cause readers to focus only on the retweeted account? We ran a small scale version ( $n=80$ , White participants only) of the experiment without the retweet (Figure 3) and again obtained statistical support only for the null hypothesis (BF range of 0.181-0.783, 1.2 to 5.5 times more support for  $H_0$ ).

Was participants' familiarity with Twitter a factor? The Prolific.co platform provided data on participants' self-reported Twitter use and we separated groups into Twitter users and non-users. Again, we obtained qualitatively the same results, regardless of whether stimuli were tweets or retweets (BF range of 0.144-0.385, 2.6 to 6.9 times more support for  $H_0$ ).

It may be that profile photos had no effect on behaviour because they were blurred. We had normed these blurred photos to ensure the skin tone was determinable, but this alone may not be sufficient to cause any bias or preferential behaviour in this task. As emoji were not blurred but also had no effect, we suspect it is unlikely that unblurring profile photos would have any effect.

Perhaps we should have included a measure of bias by administering an IAT, as per Stanley et al. (2011), and balanced participant numbers not only in terms of self-reported racial identity but also in terms of pre-existing bias. This we leave for future work and might give an interesting perspective on whether emoji can trigger biases or preferences which are already known to exist, but see prior work on issues with failure to IAT results and poor correlation between IAT scores and behavioural outcomes (Blanton et al. 2009).

Finally, the true/false trivia task may itself not be best suited to detecting the effect we set out to find. These facts are by definition trivial, and whether they are true or false is likely unimportant to the reader. By contrast, facts with real-world consequences or emotional valence might be more subject to unconscious biases surrounding the identity of the source. We did not explore that type of fact here, since the experiment would be far more challenging to design, raising both ethical questions (we want to avoid accidentally spread-

ing misinformation) and design issues (it is difficult to come up with plausible stimuli). However, such an experiment could provide important further evidence regarding situations in which identity does or does not affect perceptions of truth.

How any findings from such work would translate to the case of Twitter is not clear. On the positive side, we found strong evidence that the participants in our study were not swayed by identity signals to rate trivia as more or less true/false. This has consequences for work in disinformation. In an analysis of tweets from a Russian government-funded troll farm known as the Internet Research Agency, Freelon et al. (2020) found that fake accounts included aspects of racial presentation, using Black profile photos and names associated with Black Americans. The practice of Black impersonation in this case appeared to result in increased engagement with the content from real Twitter users, in terms of likes and retweets. However, as Freelon et al. note, there is no data on the identities of the users engaging with those tweets. One way of reconciling the findings of Freelon et al. and ours is to suppose that the increased engagement came only from additional fake bot accounts (though not necessarily from the same troll farm, as the authors found little evidence of self-amplification) rather than real users. The real users in our study seem indifferent to such identity signals in the context of behavioural influence. To better understand the interaction of users, identity, behaviour and disinformation, future work in this area should combine the experimental approach of our study and the content perspective of Freelon et al. (2020).

## Conclusion

In a controlled experiment, we found that identity signals in emoji or photos do not influence the extent to which readers perceive information as true or false. This is potentially good news in light of attempts to manipulate social media users, but future work should examine whether this result obtains for different, more realistic, types of information. Our methodology is well-documented due to the pre-registration process, making such work easier for interested researchers.

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