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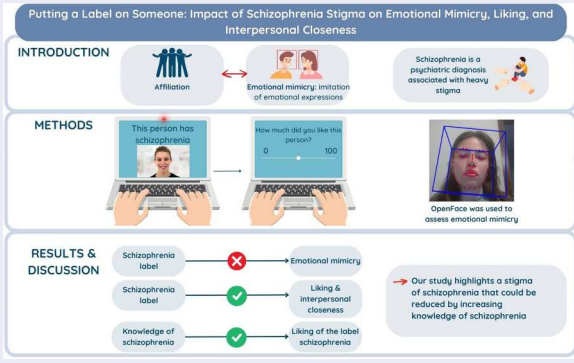
Putting a label on someone: impact of schizophrenia stigma on emotional mimicry, liking, and interpersonal closeness

Mathilde Parisi [a], Stéphane Raffard [b,c], Pierre Slangen [a], Till Kastendieck [d], Ursula Hess [d], Heidi Mauersberger [d], Tifenn Fauviaux [a] and Ludovic Marin [a]

[a]EuroMov Digital Health in Motion, Univ Montpellier, IMT Mines Ales, Montpellier, France; [b]Univ Paul Valéry Montpellier 3, Montpellier, France; [c]University Department of Adult Psychiatry, CHU Montpellier, Montpellier, France; [d]Humboldt-Universität zu Berlin, Institute of Psychology, Berlin, Germany

ABSTRACT

Affiliation is both an antecedent and a consequence of emotional mimicry (i.e. imitating a counterpart's emotional expression). Thus, interacting with a disliked partner can decrease emotional mimicry, which in turn can further decrease liking. This perpetuating circle has not been investigated in the context of mental health stigma yet. The present study tested the influence of the label "schizophrenia" on liking, interpersonal closeness, and emotional mimicry. In an online experiment (n = 201), participants recruited from the general population saw several videos of actors displaying emotional expressions. Actors were described with one of four labels: "schizophrenia", "healthy", "diabetes", and a negative adjective (e.g. "hot-tempered"). Emotional mimicry was measured using OpenFace 2.2. Liking and interpersonal closeness were assessed with questionnaires. Overall, compared to other labels, participants reported less liking and interpersonal closeness to the actor with the schizophrenia label. However, no effect on emotional mimicry was found. The decreased liking of the schizophrenia actors was explained by a lack of knowledge about schizophrenia and the explicit stigma of schizophrenia. Our study contributes to the literature by highlighting the need to reduce the stigma of schizophrenia.



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1. Introduction

During social interactions, the perception of the behaviour of the interaction partner can automatically trigger a matching expression in the observer. This phenomenon is referred to as behavioural mimicry and is associated with many social benefits such as

CONTACT Mathilde Parisi mathilde.parisi@umontpellier.fr EuroMov Digital Health in Motion, Univ Montpellier, IMT Mines Ales, 700 avenue du Pic Saint-Loup, 34090, Montpellier, France

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increased liking, empathy, and helping behaviour (Chartrand & Lakin, 2013). A specific case of mimicry is emotional mimicry, the imitation of a counterpart's emotional expressions (e.g. facial expressions, vocalisation, posture, or movements) (Hess & Fischer, 2013).

Emotional mimicry is a rapid, automatic (Dimberg & Thunberg, 1998) but goal-dependent (Hess & Fischer, 2022) process defined by four characteristics (Hess & Fischer, 2014). To begin, the mimicker and the mimickee must show matching emotional expressions (1). In addition, the expression of the mimicker is time-locked to the expression of the mimickee (2) and must occur rapidly (i.e. within one second) (3). Finally, emotional mimicry depends on an affiliative link between the mimickee and the mimicker (4) (Hess & Fischer, 2014).

According to recent theories, emotional mimicry is a social regulator that smoothens social interaction by fostering affiliation (Hess & Fischer, 2022). This function of fostered affiliation is appreciable on three levels: the mimickee, the mimicker, and the quality of the interaction. For instance, by mimicking an emotional expression, the mimicker shows his/her understanding of the counterpart's emotions and his/her alignment with his/her perspective making them more likable (Hess & Fischer, 2014). In addition, mimicking someone leads to increased empathy and pro-social behaviours toward the mimickee (Stel et al., 2008). Finally, increased affiliative emotional mimicry was found to be associated with increased social interaction quality (Mauersberger & Hess, 2019).

Notably, emotional mimicry is moderated by social context, which directly impacts its social benefits (Hess & Fischer, 2022). For instance, Bourgeois and Hess (2008) studied facial reactions to emotion displays of ingroup and outgroup members defined by political beliefs and sporting activities. Their results highlighted that participants did not mimic negative emotional expressions of outgroup contrary to ingroup members (Bourgeois & Hess, 2008). Using both electromyography (EMG) and the Facial Action Coding System (FACS) (Ekman & Friesen, 1978), van der Schalk, Hawk, et al. (2011) replicated these findings using the university major as the defining characteristic of in-group and outgroup (i.e. psychology students vs economics students). Similar results were found by manipulating liking. For instance, McIntosh (2006) found that participants showed less mimicry in response to "unlikeable" individuals or strangers compared to likable individuals or friends (McIntosh, 2006). In some cases, participants even tend to produce incongruent mimicry in reaction to negative characters (Likowski et al., 2008) or to dissimilar counterparts (Olszanowski et al., 2022).

These studies highlight that emotional mimicry is diminished, suppressed, or even incongruent when the sender is perceived as dissimilar, or unlikable (Bourgeois & Hess, 2008; Likowski et al., 2008; Olszanowski et al., 2022; van der Schalk, Fischer, et al., 2011). In this vein, Hess and Fischer (2022) posit that congruent emotional mimicry, and the resulting social benefits, only occur when the relationship is perceived as positive, and mimickers have a desire for affiliation. In other words, affiliation is both an antecedent and a consequence of emotional mimicry (Hess & Fischer, 2022). Salazar Kämpf et al. (2018) experimentally demonstrated this perpetuating circle between affiliation and emotional mimicry by showing that liking induced more mimicry which in turn led to more liking (Salazar Kämpf et al., 2018). This perpetuating circle is beneficial if the counterpart is positively appraised, however, when the counterpart is perceived negatively, a vicious circle could result that promotes social exclusion. This vicious circle could strongly affect stigmatised individuals who already suffer from social isolation.

For instance, schizophrenia is a psychiatric diagnosis characterised by three categories of symptoms: positive symptoms (e.g. delusions, hallucination), negative symptoms (e.g. social isolation), and disorganised symptoms (behaviours and speech). In addition, the degradation and diminution of social interactions are a defining characteristic of schizophrenia which is associated with social skills deficits (Hooley, 2010) and heavy stigmatisation (Wood et al., 2014).

Public stigma is considered the convergence of four components: (1) labelling human differences, (2) associating this label with negative stereotypes, (3) separating the ones labelled from others, and (4) status loss and discrimination against the ones labelled (Link & Phelan, 2001). Many studies have demonstrated that people with psychiatric diagnoses are strongly stigmatised and associated with negative public attitudes and emotional reactions including increased public fear and desire for limited social interaction (Angermeyer & Matschinger, 2003; Link et al., 1999). In this context, schizophrenia is considered the most stigmatised mental health diagnostic (Wood et al., 2014). Individuals with schizophrenia are believed to be more dangerous, unpredictable, socially incompetent, and less likely to recover compared to other mental health

diagnoses such as depression or anxiety (Angermeyer & Matschinger, 2003; Wood et al., 2014). Finally, people with psychiatric diagnoses suffering from public stigma also tend to internalise the beliefs and ideas that they are less valued (Corrigan & Watson, 2002). This phenomenon is characterised as self-stigma and is associated with negative stereotypes (e.g. incompetence), prejudice (e.g. negative emotional reaction, low self-esteem), and discrimination (e.g. failure to pursue work and housing opportunities) against oneself (Corrigan & Watson, 2002).

There are a variety of methodologies to measure the stigma of mental diagnoses (Link et al., 2004). Currently, studies have pointed to the necessity to measure the stigmatisation of mental illness implicitly to reduce social desirability bias (Burguet & Girard, 2023; González-Sanguino et al., 2019). Recent work used the label "schizophrenia" to ascertain its impact on various implicit emotional and interpersonal reactions. For instance, Rainteau et al. (2020) demonstrated that healthy participants produced more synchrony errors when they believed they were interacting with a patient with schizophrenia compared to a healthy participant (Rainteau et al., 2020). In addition, one study measured brain activity in response to pictures of actors labelled as "healthy" or "having schizophrenia" (Grose-Fifer & Vidals, 2021). The results showed that participants exhibited different brain activity when they believed the individuals had schizophrenia compared to when they believed the person was healthy (Grose-Fifer & Vidals, 2021).

To our knowledge, to date no study has assessed the influence of mental health diagnoses and the associated stigma on emotional mimicry and its antecedents. As noted above, emotional mimicry is an automatic behaviour and therefore can be considered an implicit measure of the effect of a stigmatising label on interpersonal interactions.

In this study, we therefore, aimed to test whether the stigmatising label "schizophrenia" influences emotional mimicry of joy and sadness. We chose to investigate emotional mimicry in response to joy and sadness, given that these emotions convey affiliative intentions (Hess & Fischer, 2014; Van Kleef, 2010). While smiles are commonly associated with affiliation, it's essential to acknowledge that negative emotions, like sadness, also carry affiliative qualities. For example, expressing feelings of helplessness and a need for support through sadness can prompt others to extend assistance or provide consolation (Van Kleef, 2010). In contrast, expressions of anger differ in terms of social meaning signalling potential animosity (Hess & Fischer, 2014). Research suggests that antagonistic emotions, like anger, are more likely to elicit emotional reactions rather than mimicry, aligning with the notion that mimicry both requires and fosters affiliation (Hess & Fischer, 2014; Wróbel et al., 2021). Furthermore, our decision to include both joy and sadness was informed by previous studies indicating that smiles can be mimicked by both ingroup and outgroup members due to their low social cost, in contrast to the mimicry of sadness expressions (Bourgeois & Hess, 2008).

In addition, as emphasized previously, most studies that measured the influence of group membership on emotional mimicry also assessed liking and/ or interpersonal closeness as antecedents of mimicry (Bourgeois & Hess, 2008; Likowski et al., 2008; Olszanowski et al., 2022; van der Schalk, Fischer, et al., 2011). Indeed, previous studies have demonstrated that these variables mediate the influence of social context on emotional mimicry (Kastendieck et al., 2020; Peng et al., 2021). Consequently, we assessed whether the stigmatising label "schizophrenia" influences these antecedents of emotional mimicry. By measuring the influence of the label "schizophrenia" on emotional mimicry, liking, and interpersonal closeness, we aim to highlight the impact of the stigmatised label on both explicit (ratings of liking and closeness) and implicit (emotional mimicry) reactions. We further used a validated tool for assessing explicit stigma to examine the connections between explicit stigma, liking/closeness, and mimicry.

Finally, many anti-stigma campaigns have focused on increasing knowledge of schizophrenia (Pinfold et al., 2005; Rüsch et al., 2005; Simmons et al., 2017). Consequently, we assess whether the implicit stigmatised reactions to the label "schizophrenia" are linked to a lack of knowledge about schizophrenia to demonstrate the need for such campaigns.

1.1. Present study

To test the influence of a stigmatising label on liking, interpersonal closeness, and emotional mimicry, we conducted an online experiment on Sosci Survey using twenty-four short video clips of actors from The Amsterdam dynamic facial expression set displaying joy and sadness (ADFES, van der Schalk, Hawk, et al., 2011).

We assigned one of four possible labels to the actors on the AFDES. The first label was "schizophrenia", while the others were included as controls. The central focus is the comparison between reactions to individuals with the "schizophrenia" label and those with the "healthy" label. However, since differential reactions to these two labels might be due to the latter being a health diagnosis, we included the label "diabetes" to include a second health condition as a comparison. Additionally, the label "healthy" implies the absence of a negative trait/state. Therefore, we included a "negative adjective" label to separate the effect of stigma from the effect of a negative trait. To ensure that the negative traits were perceived as negatively as "schizophrenia" we conducted a pretest where thirty participants assessed thirty adjectives on a scale from 1 (very negative) to 10 (very positive). Among the thirty adjectives, ten pertained to health diagnoses (including diabetes and schizophrenia), ten were positive adjectives (e.g. generous), and ten were negative adjectives. Based on this pretest, we selected three negative adjectives: "lazy", "hot-tempered" and "intolerant" (for details see the supplementary materials). Consequently, the use of four labels allowed us to distinguish the effect of stigma from the impact of a negative trait or a health diagnosis.

We employed a within-subject design, such that each participant viewed all twenty-four video clips featuring the AFDES and the accompanying four-label presentation. Within these twenty-four video clips, every label was linked to six videos. The assignment of labels to the videos was counterbalanced across participants.

While watching the videos, participants' faces were automatically recorded with their computer's webcam, and the recordings were uploaded to the Sosci Survey platform. We used the uploaded video of participants to measure emotional mimicry via an automated software, OpenFace 2.2, (Baltrusaitis et al., 2018) following previous mimicry studies' methodology (Kastendieck et al., 2021; Mauersberger et al., 2022). After they saw the video, participants appraised the actors using questionnaires (liking and interpersonal closeness).

(H1) Participants express reduced liking of actors labeled as having schizophrenia compared to other labels (i.e. healthy, diabetes, negative adjective).

(H2) Participants experience reduced closeness to actors labeled as having schizophrenia compared to the other labels (i.e. healthy, diabetes, negative adjective).

(H3) Participants show reduced emotional mimicry in response to actors labeled as having schizophrenia compared to the other labels (i.e. healthy, diabetes, negative adjective).

(H4) The influence of the label "schizophrenia" on liking, interpersonal closeness, and emotional mimicry can be explained by explicit stigma.

(H5) The influence of the label "schizophrenia" on liking, interpersonal closeness, and emotional mimicry can be explained by level of knowledge about schizophrenia.

2. Methods

This protocol was approved by the Ethical Comity of Université de Montpellier (n°UM 2022-016bis). All participants received an information letter and signed a consent form.

This protocol and the hypotheses previously presented were preregistered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/ZE3Q4). In addition, analytic code, statistical analyses, and pretest analyses were uploaded to the OSF project (osf.io/kqea7).

2.1. Participants

Studies on emotional mimicry usually report an effect size between $\eta_p^2 = 0.15$ and $\eta_p^2 = 0.30$ for electromyography (EMG). We conducted an ANOVA-oriented power analysis. We used G*Power 3.1.9.7 to estimate the required sample size to detect the effect of the label schizophrenia in contrast to the other three labels on emotional mimicry considering an effect size of 0.15. Results indicated that the sample size required to reach a power of 0.95 to detect an effect of 0.15, at a significance level of 0.05, is $N = 116$. However, because our experiment was conducted online, oversampling was required to compensate for predetermined exclusion criteria. Consequently, we aimed to recruit at least 200 participants. Non-inclusion criteria for this experiment were the following: reporting severe mental illness, neurological symptoms, intellectual deficiency, or diabetes of type 1 or 2.

The participants were recruited through social media and announcements in various universities. Upon recruitment, participants received an email containing study-related information and a link to initiate the questionnaire. Throughout the study, participants were aware that they would be filmed, and at the beginning of the questionnaire, they were instructed to adjust their cameras to ensure their faces were

fully visible. However, once the experiment started, participants could not see themselves while being recorded, and they were unable to view the recorded videos. These videos were automatically saved on the platform. However, at the end of the experiment, participants had the option to withdraw their consent, leading to the deletion of the recorded videos. Participants were not allowed to go back or restart the study once they had progressed beyond the instructions stage.

A total of 201 participants completed the online experiment. Two participants were excluded because they reported having not seen some of the stimuli. Twenty-three participants were excluded because no video of the participant was successfully uploaded. Four participants were excluded because parts of their faces were hidden in the video. The final sample consisted of 171 participants including 92 women (53.8%) and 79 men (46.2%). The mean age was 31 years (SD = 14.9 years). Participants originated from all regions of France. The sample consisted of artisans (2.4%), managers (20.5%), employees (3.6%), students (52.4%), manual workers (0.6%), intermediate occupation (5.4%), retired (3%), unemployed (4.8%), and others (7.2%).

Each uploaded video was visualised by a researcher to check participants' behaviours (behaviours requiring the video to be excluded were looking away from the screen, yawning, eating, speaking, and having part of the face obstructed). In addition, frames with detection confidence below 75% according to OpenFace 2.2 were deleted. In this final sample, 224 videos were either missing or excluded due to poor OpenFace confidence (i.e. lower than 0.75), corresponding to 5.5% of the total number of videos. For the remaining videos, the mean OpenFace confidence was 0.965 (SD = 0.064).

2.2. Stimuli

The stimuli were short video clips of facial expressions evolving from neutral to sadness or happiness. Twelve actors were selected from the Amsterdam Dynamic Facial Expression Northern European Set each depicting sadness and happiness (ADFES, van der Schalk, Hawk, et al., 2011). The stimuli consisted of seven male actors and five female actors (the ADFES northern European set only includes five women). The study design was within-subject; participants viewed a total of 24 videos (12 actors* 2 emotions). The videos were 7.5 s long, the first 1.5 s being a fixation cross, then the actor displayed a neutral expression for 1 s followed by a gradually increasing emotional expression.

2.3. Procedure

The online experiment was created on Sosci Survey. Participants first saw an information letter and a consent form in which they were asked several times if they agreed to activate their webcams during the experiment. If participants agreed to the conditions, they were asked to complete the demographic information (age, sex, region of living, and occupation). We decided to create a cover story to shift focus from the real purpose of our experiment: thus, participants were told that the experiment aimed to assess their opinions regarding antidepressants. More specifically, participants were informed that they would be presented with numerous individuals exhibiting diverse characteristics and health diagnoses. Participants were told that our specific interest lay in gauging whether they believed these individuals were currently using antidepressants or not. To reinforce the cover story, participants answered a few questions about antidepressants such as "Would you recommend someone with depression to take antidepressants?". Following the cover story questions participants began the experiment.

To assess the influence of a stigmatising label on emotional mimicry, liking, and interpersonal closeness, we created a within-subject design with four experimental conditions (corresponding to the four labels: schizophrenia, diabetes, healthy, and negative adjective). For the condition "negative adjective", actors were either described as "hot-tempered", "intolerant", or "lazy". The negative adjective attribution was counterbalanced between participants.

Participants saw four blocks of six videos. Each block was composed of three actors (at least one man and one woman) depicting happiness in one video and sadness in another video (3 actors*2 emotions). The six stimuli of the same group appeared one after the other and were associated with the same label, so the participants were not confused by a rapid change of labels. Before each block of videos started, the participants were told which group of individuals they were about to observe (e.g. "For the first block of six videos, you will see individuals with schizophrenia"). The order of labels assigned to each block was counterbalanced between participants. In addition, the order of the six videos inside each

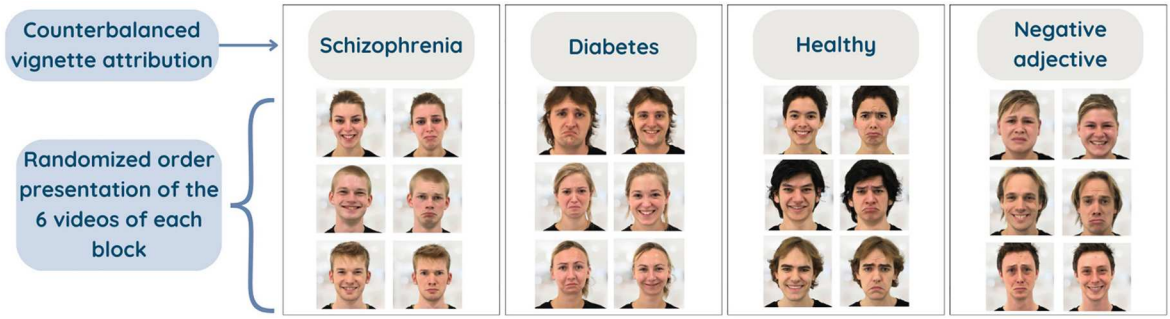

Figure 1. Experimental design.

Note: Each block of six videos was composed of three actors displaying happiness in one video and sadness in the other video. The order of the four blocks of six videos remained unchanged between participants while the order of the six videos inside each block was randomised. The label for each block was counterbalanced between participants.

block was randomised for every participant (see Figure 1).

During the video presentation, a message was presented on top of the video to remind participants of the label associated with the individual on the video (e.g. "This person has schizophrenia"). The software was preconfigured to automatically initiate webcam recording when the video commenced and cease recording when the video concluded. Consequently, the uploaded participant videos matched the length of the stimuli precisely.

Following the video, participants had to choose which of six possible emotions (joy, sadness, anger, surprise, fear, and disgust) was depicted by the actor in the video. We chose to assess emotion recognition because it was demonstrated to enhance emotional mimicry (Murata et al., 2016). Then, participants responded to the Inclusion of Other in the Self-scale (Aron et al., 1992) to assess perceived interpersonal closeness. This scale contains seven options of overlapping pairs of two circles; one circle represents the participant, and the other represents the person on the stimulus. The scores range from 1 (circle the most far away) to 7 (circle closest to one another). Finally, participants had to rate how much they liked the person on the video on a 100-slider scale (0 = "not at all", 100 = "a lot") and whether they believed this person was taking antidepressants (see Figure 2).

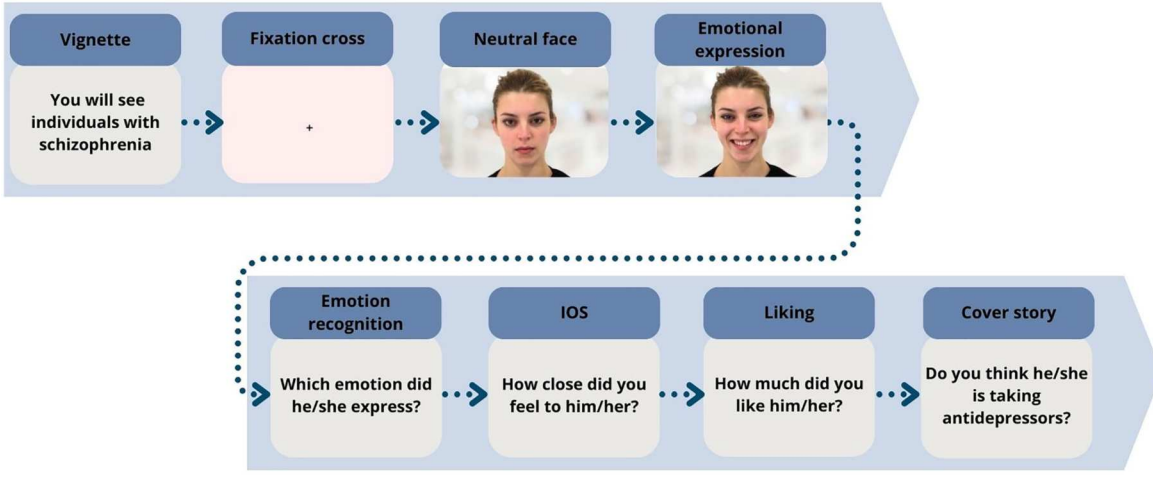

Figure 2. Trial organisation.

Note: each block begins with the label. Each trial began with the video (fixation cross, neutral face, emotional expression), followed by the emotion recognition question, the IOS, the liking assessment, and the cover story question.

The experiment began with a test trial. Then participants completed the 24 trials with a message indicating when they moved to the next group of individuals.

The experiment ended with questionnaires assessing their social distance from schizophrenia (stigma) and their knowledge of schizophrenia. The Social Distance Scale (SDS) is composed of seven questions (e.g. "How would you feel about having someone diagnosed with schizophrenia as a neighbor?"). Participants had to answer on a 100-slider scale (0 = "completely disagree" and 100 = "completely agree"). The scores from the seven questions were added (Link et al., 1987). Consequently, a lower score indicates more desire to socially distance from individuals with schizophrenia. Knowledge of schizophrenia was evaluated using the French translation of the Knowledge About Schizophrenia Test (KAST) (Compton et al., 2007), with 18 multiple-choice questions. Every correct answer resulted in one point. The total score for each participant ranges from 0 to 18 and a higher score indicates a better knowledge of schizophrenia.

After the experiment, participants were queried about any challenges they encountered with the questionnaire and their assumptions regarding our research hypothesis. Four participants (2%) correctly speculated that the study involved an investigation into their facial reactions. Twenty-eight participants (16%) indicated that they were unsure, while the remaining participants believed our focus was on discerning whether individuals in the videos were taking antidepressants, deducing this from their diagnosis/description and facial characteristics.

Finally, participants were thanked and told the real purpose of the study, they were also directed to a website to better understand what schizophrenia is.

2.4. Facial expression analysis

Participants' facial expressions were analysed using OpenFace 2.2 following the methodology of Kastendieck et al. (2021). OpenFace is an open-source software capable of monitoring the activity of facial action units according to the Facial Action System (FACS, Ekman & Friesen, 1978). To measure emotional mimicry of happy and sad facial expressions, we were interested in three action units, AU4 (brow furrow, resulting from the activity of the corrugator supercilii), AU6 (cheek raiser, resulting from the activity of the orbicularis oculi), and AU12 (lip corner puller, resulting from the activity of the zygomaticus major). To control for participants' natural expressiveness, we computed a baseline correction by subtracting their action unit activation from the fixating cross to the action unit activation during the stimuli presentation (Kastendieck et al., 2021). The baseline-corrected activation was within the subjects' z-transformed. With the baseline corrected, within-subjects z-standardised activation, we computed pattern scores for happiness and sadness mimicry as follows, ((AU12 + AU06)/2) – AU04 for happiness mimicry and AU04 – ((AU12 + AU06)/2) for sadness mimicry (Hess et al., 2017; Kastendieck et al., 2021; Mauersberger et al., 2022). These activation patterns were initially proposed in the context of electromyography (Hess et al., 2017) and subsequently adapted for OpenFace (Kastendieck et al., 2021; Mauersberger et al., 2022). Positive emotional expressions are characterised by heightened activity in the zygomaticus major (AU12) and the orbicularis oculi (AU06), coupled with diminished activity in the corrugator supercilii (AU04) (Hess et al., 2017). Conversely, the reverse contrast signifies negative emotional expression. Our emphasis on comparing activation patterns, rather than individual action unit activations, aligns with the perspective outlined by Hess and Fischer (2013, 2014). They argue that emotional mimicry need not precisely replicate an emotional display; instead, it is defined by matching emotional expressions in terms of valence (Hess & Fischer, 2013, 2014).

Consequently, for each trial, we computed a within-subject z-standardised baseline corrected mean happiness mimicry score and a within-subject z-standardised baseline corrected mean sadness mimicry score for each segment of the stimuli which gradually evolved from a neutral expression to apex ("beginning" 0–2 s, "middle" 2–4 s, and "apex" 4–6 s).

3. Results

To test our hypotheses, we conducted linear mixed model analyses. For contrast analyses, we applied Tukey HSD to correct for familywise error rate.

3.1. Emotion recognition

To assess emotion recognition, participants had to choose the label that corresponded to the emotion expressed among six possibilities (joy, sadness, fear, disgust, anger, and surprise). Participants chose the correct emotions for 84.1% of the trials. More specifically, participants chose joy for 96% of

the joy trials and sadness for 72% of the sadness trials. Sadness stimuli were mostly confused with disgust (14% of the sadness trials) and fear (7.5% of the sadness trials).

3.2. Liking

We conducted a linear mixed model analysis with the fixed factors condition (reference: schizophrenia) and target emotion (reference: joy). The linear mixed model analysis included a random intercept for the cluster variable participant ID and random slopes for condition and target emotion. The analysis revealed significant fixed effects estimates for condition (diabetes: $\beta = 5.41$, $p < 0.001$, CI_{95}[2.52, 8.29], Cohen's d = −0.36; healthy: $\beta = 6.04$, $p < 0.001$, CI_{95}[3.25, 8.83], es = −0.40), target emotion ($\beta = -16.37$, $p < 0.001$, CI_{95}[−19.33, −13.40], Cohen's d = 1.41), and the condition*target emotion interaction (diabetes: $\beta = -3.44$, $p = 0.028$, CI_{95}[−6.51, −0.37], Cohen's d = −0.13, healthy: $\beta = -4.69$, $p = 0.001$, CI_{95}[−7.52, −1.87], Cohen's d = −0.08) on liking (see Figure 3).

For the joy stimuli, contrast analyses revealed that participants liked the actors with the label schizophrenia less compared to actors labelled as diabetic (schizophrenia vs diabetes: $\beta = -5.4$, $t = -4.41$, $p < 0.0001$, CI_{95}[−8.57, −2.24], Cohen's d = −0.36) or healthy (schizophrenia vs healthy: $\beta = -6.0$, $t = -4.41$, $p < 0.0001$, CI_{95}[−9.14,−2.94], Cohen's d = −0.40). Significant differences were also found between the healthy label and the negative adjective (healthy vs negative adjective: $\beta = 4.03$, $t = 3.55$, $p = 0.004$, CI_{95}[1.1, 6.95], Cohen's d = 0.26). That is, participants liked actors labelled healthy more than those labelled with a negative adjective.

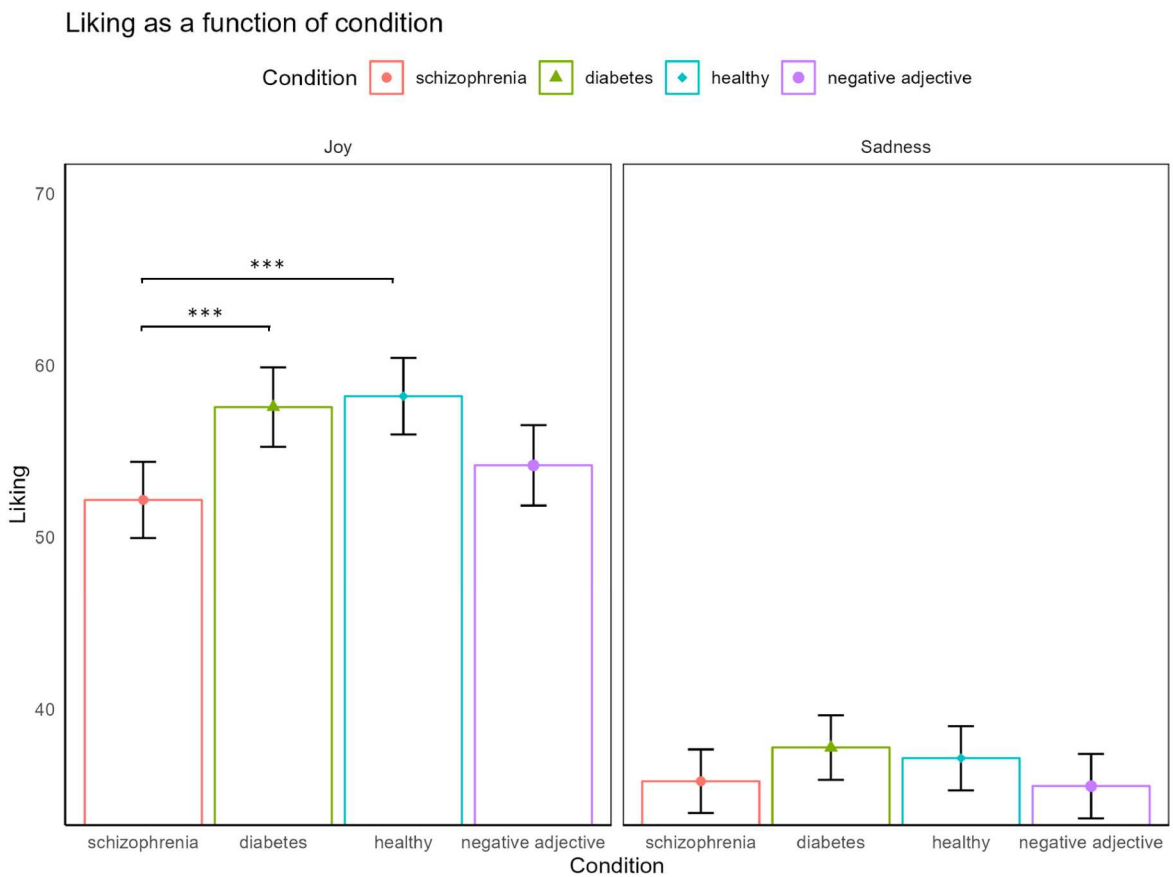

Figure 3. Liking as a function of condition (i.e. the label) for joy and sadness stimuli.

Note: liking was assessed on a 100 scale (0 = "not at all", 100 = "a lot") after the question "How much did you like this person?". Significance levels: *** ($p < 0.001$). Symbols represent the mean in each condition and the black line represents the 95%-confidence intervals.

For sadness stimuli, no significant differences in liking between labels emerged (schizophrenia vs diabetes: $\beta = -1.96$, $t = -1.60$, $p = 0.38$, $CI_{95}[-5.13, 1.20]$; schizophrenia vs healthy: $\beta = -1.34$, $t = -1.12$, $p = 0.68$, $CI_{95}[-4.43, 1.76]$; schizophrenia vs valence: $\beta = 0.28$, $t = 0.23$, $p = 0.99$, $CI_{95}[-2.88, 3.44]$).

Concerning the joy vs sadness contrast, for every condition, participants liked actors more when they displayed joy rather than sadness (schizophrenia joy vs sadness: $\beta = 16.4$, $t = 10.2$, $p < 0.0001$, $CI_{95}[13.2, 19.5]$, Cohen's $d = 1.08$, diabetes joy vs sadness: $\beta = 19.8$, $t = 12.3$, $p < 0.0001$, $CI_{95}[16.6, 23.0]$, Cohen's $d = 1.30$, healthy joy vs sadness: $\beta = 21.1$, $t = 13.1$, $p < 0.0001$, $CI_{95}[17.9, 24.2]$, Cohen's $d = 1.39$, negative adjective joy vs sadness: $\beta = 18.7$, $t = 11.6$, $p < 0.0001$, $CI_{95}[15.5, 21.8]$, Cohen's $d = 1.23$).

3.3. Interpersonal closeness

We conducted a linear mixed model analysis with the fixed factors condition (reference: schizophrenia) and target emotion (reference: joy). The linear mixed model analysis included a random intercept for the cluster variable participant ID and random slopes for condition and target emotion. The analysis revealed significant fixed effects estimates for the condition (diabetes: $\beta = 0.34$, $p < 0.001$, $CI_{95}[0.17, 0.52]$, es = −0.36; healthy: $\beta = 0.46$, $p < 0.001$, $CI_{95}[0.27, 0.65]$, es = −0.48; negative adjective: $\beta = 0.26$, $p = 0.004$, $CI_{95}[0.07, 0.44]$, es = −0.27), the target emotion ($\beta = -1.18$, $p < 0.001$, $CI_{95}[-1.36, -1]$, es = 1.36), and the condition healthy*target emotion interaction ($\beta = -0.21$, $p = 0.01$, $CI_{95}[-0.40, -0.03]$, es = −0.26) on interpersonal closeness with the actor (see Figure 4).

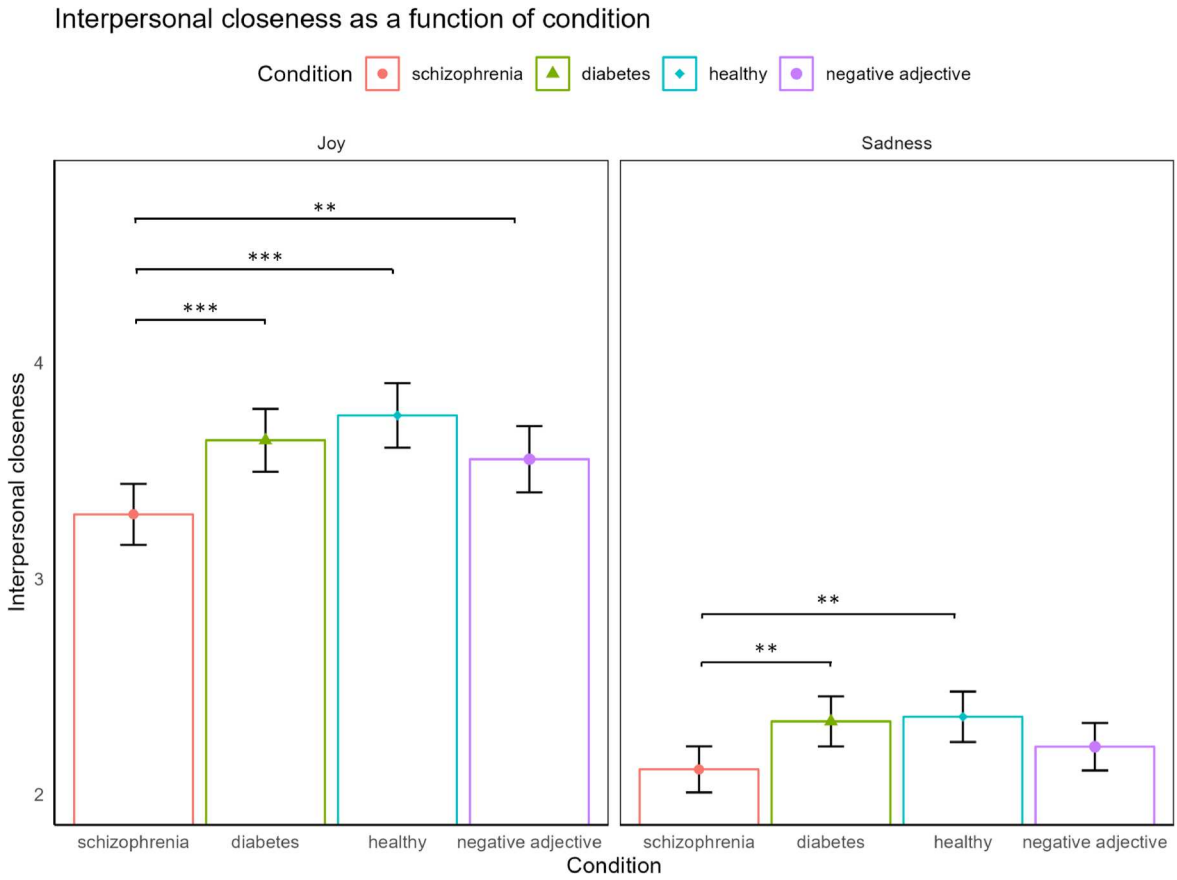

Figure 4. Interpersonal closeness as a function of condition (i.e. the label) for joy and sadness stimuli.

Note: The interpersonal closeness was assessed using the IOS. Participants had to answer the question "How similar/ close do you feel to this person?" and had to answer by choosing one of seven pairs of circles. The response scale ranged from 1 ("not similar at all") to 7 ("very similar"). Significance levels: *** ($p < 0.001$), ** ($p < 0.01$). Symbols represent the mean in each condition and the black line represents the 95%-confidence intervals.

For both joy and sadness stimuli, contrast analyses indicated that participants felt closer to actors with the label diabetes compared to the label schizophrenia (schizophrenia vs diabetes joy: $\beta = -0.34$, $t = -4.8$, $p < 0.001$, $CI_{95}[-0.53, -0.16]$, Cohen's d = −0.36; schizophrenia vs diabetes sadness: $\beta = -0.22$, $t = -3.1$, $p = 0.01$, $CI_{95}[-0.41, -0.04]$, Cohen's d = −0.23). Participants also felt closer to actors with the label healthy compared to the label schizophrenia (schizophrenia vs healthy joy: $\beta = -0.46$, $t = -5.79$, $p < 0.001$, $CI_{95}[-0.66, -0.25]$, Cohen's d = −0.48; schizophrenia vs healthy sadness: $\beta = -0.24$, $t = -3.1$, $p = 0.01$, $CI_{95}[-0.45, -0.04]$, Cohen's d = −0.26).

For the negative adjective label, participants felt closer to the actors in comparison to the label schizophrenia only for joy stimuli (schizophrenia vs negative adjective: $\beta = -0.26$, $t = -3.57$, $p = 0.004$, $CI_{95}[-0.44, -0.07]$, Cohen's d = −0.27) but not for sadness (schizophrenia vs negative adjective: $\beta = -0.11$, $t = -1.47$, $p = 0.46$, $CI_{95}[-0.29, 0.08]$). Significant differences were also found between the healthy and the negative adjective labels for joy stimuli only (healthy vs negative adjective: $\beta = 0.20$, $t = -2.81$, $p = 0.035$, $CI_{95}[0.02, 0.39]$, Cohen's d = 0.21).

Concerning the joy vs sadness contrast, for every condition, participants felt closer to the actors when they expressed joy compared to sadness (schizophrenia joy vs sadness: $\beta = 1.18$, $t = 11.8$, $p < 0.0001$, $CI_{95}[0.99, 1.40]$, Cohen's d = 1.24, diabetes joy vs sadness: $\beta = 1.30$, $t = 13.0$, $p < 0.0001$, $CI_{95}[1.1, 1.50]$, Cohen's d = 1.37, healthy joy vs sadness: $\beta = 1.40$, $t = 14.0$, $p < 0.0001$, $CI_{95}[1.20, 1.60]$, Cohen's d = 1.46, negative adjective joy vs sadness: $\beta = 1.33$, $t = 13.35$, $p < 0.0001$, $CI_{95}[1.13, 1.53]$, Cohen's d = 1.40).

3.4. Emotional mimicry

We performed two separate analyses (one for the joy stimuli and one for the sadness stimuli) to assess the influence of the fixed factors condition and segment on emotional mimicry. Positive mimicry scores were utilised for the joy stimuli analysis (((AU12 + AU06)/2) − AU04), whereas negative mimicry scores were employed for the sadness stimuli analysis (AU04 − ((AU12 + AU06)/2)). In addition to conducting contrast analyses, we also performed a single AU analysis, which can be found in the supplementary materials (for this analysis, the labels did not significantly impact participants' single AU activation).

3.4.1. Joy stimuli

We conducted a linear mixed model analysis with the fixed factors segment (reference: beginning) and condition (reference: schizophrenia). The linear mixed model analysis included a random intercept for the cluster variable participant ID and random slopes for condition and segment type (i.e. beginning, middle, apex). The analysis revealed significant fixed effect estimates for the segment ($\beta = 0.98$, $p = 0.006$, $CI_{95}[0.28, 1.68]$, es = −0.15). The fixed factor condition was not significant (diabetes: $\beta = -0.00$, $p = 0.99$, $CI_{95}[-0.81, 0.80]$, healthy: $\beta = 0.54$, $p = 0.14$, $CI_{95}[-0.17, 1.25]$, negative adjective: $\beta = -0.30$, $p = 0.62$, $CI_{95}[-1.47, 0.88]$).

To assess whether mimicry was present we used contrasts to verify that participants congruent emotion expression increased significantly from the first segment (where actors showed a neutral expression) to the apex segment of the video. The contrast analyses indicated more congruent mimicry at the apex compared to the beginning (beginning vs apex: $\beta = -0.80$, $p < 0.0001$, $CI_{95}[-0.90, -0.20]$, Cohen's d = −0.15) and the middle (apex vs middle: $\beta = 0.43$, $p = 0.03$, $CI_{95}[-0.55, -0.17]$, Cohen's d = 0.08) of the video (see Figure 5).

3.4.2. Sadness stimuli

We conducted a linear mixed model analysis with the fixed factors segment (reference: beginning) and condition (reference: schizophrenia). The linear mixed model analysis included a random intercept for the cluster variable participant ID and random slopes for condition and segment type (i.e. beginning, middle, apex). The analysis revealed significant fixed effect estimates for the segment apex ($\beta = 0.43$, $p = 0.03$, $CI_{95}[0.04, 0.82]$). The fixed factor condition was not significant (diabetes: $\beta = -0.86$, $p = 0.36$, $CI_{95}[-2.72, 1.0]$, healthy: $\beta = -0.35$, $p = 0.49$, $CI_{95}[-1.34, 0.64]$, negative adjective: $\beta = -0.35$, $p = 0.27$, $CI_{95}[-0.97, 0.27]$).

To assess whether mimicry was present we used contrasts to verify that participants congruent emotion expression increased significantly from the first segment (where actors showed a neutral expression) to the apex segment of the video. The contrast analyses indicated more congruent mimicry at the apex compared to the beginning of the video (beginning vs apex: $\beta = -1.23$, $p = 0.01$, $CI_{95}[-1.45, -0.03]$, Cohen's d = −0.09) (see Figure 5).

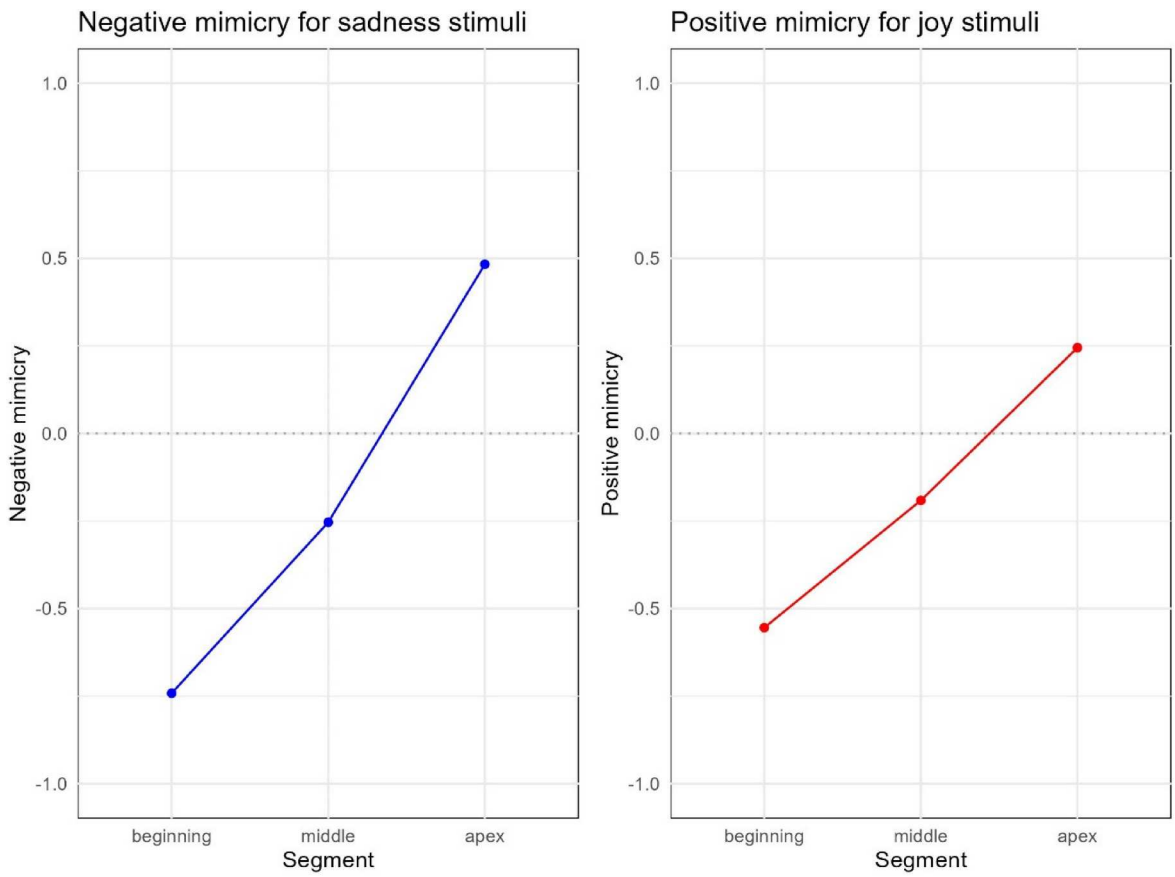

Figure 5. Negative mimicry scores (baseline corrected within-subjects z-standardised) for sadness stimuli as a function of the segment (left) and Positive mimicry scores (baseline corrected within-subjects z-standardised) for joy stimuli as a function of the segment (right).

Note. The stimuli length (without the fixation cross) were 6 s. The participants' video was segmented in three parts with the beginning corresponding to the first two seconds, the middle corresponding from two to four seconds and the apex corresponding to the last two seconds. Concerning mimicry scores, a higher score indicates more congruent mimicry.

3.5. Knowledge of schizophrenia and social distance scale

One of our objectives was to assess whether knowledge of schizophrenia and the social distance to schizophrenia explained the appraisal (i.e. interpersonal closeness and liking) of the actor with the label "schizophrenia".

We conducted one linear mixed model analysis with interpersonal closeness ratings of actors with the schizophrenia label as the dependent variable and participants' KAST and SDS scores as the predictors. Results highlighted that interpersonal closeness was significantly explained by the social distance to schizophrenia ($\beta = 0.003$, $t = 3.55$, $p < 0.001$) but not by the level of knowledge about schizophrenia ($\beta = 0.02$, $t = 0.75$, $p = 0.45$). In other words, the more participants wanted to socially distance themselves from individuals with schizophrenia, the less they felt close to the actors with the label "schizophrenia".

We conducted another linear mixed model analysis with liking ratings of actors with the schizophrenia label as the dependent variable and participants' KAST and SDS scores as the predictors. Results suggested that for actors shown with the label schizophrenia, liking was significantly explained by both the social distance to schizophrenia ($\beta = 0.031$, $t = 3.11$, $p = 0.003$) and the level of knowledge about schizophrenia ($\beta = 1.17$, $t = 2.22$, $p = 0.03$). More specifically, the more participants wanted to socially distance themselves from individuals with schizophrenia (characterised by a smaller score of SDS), the less they liked the actors with the "schizophrenia" label

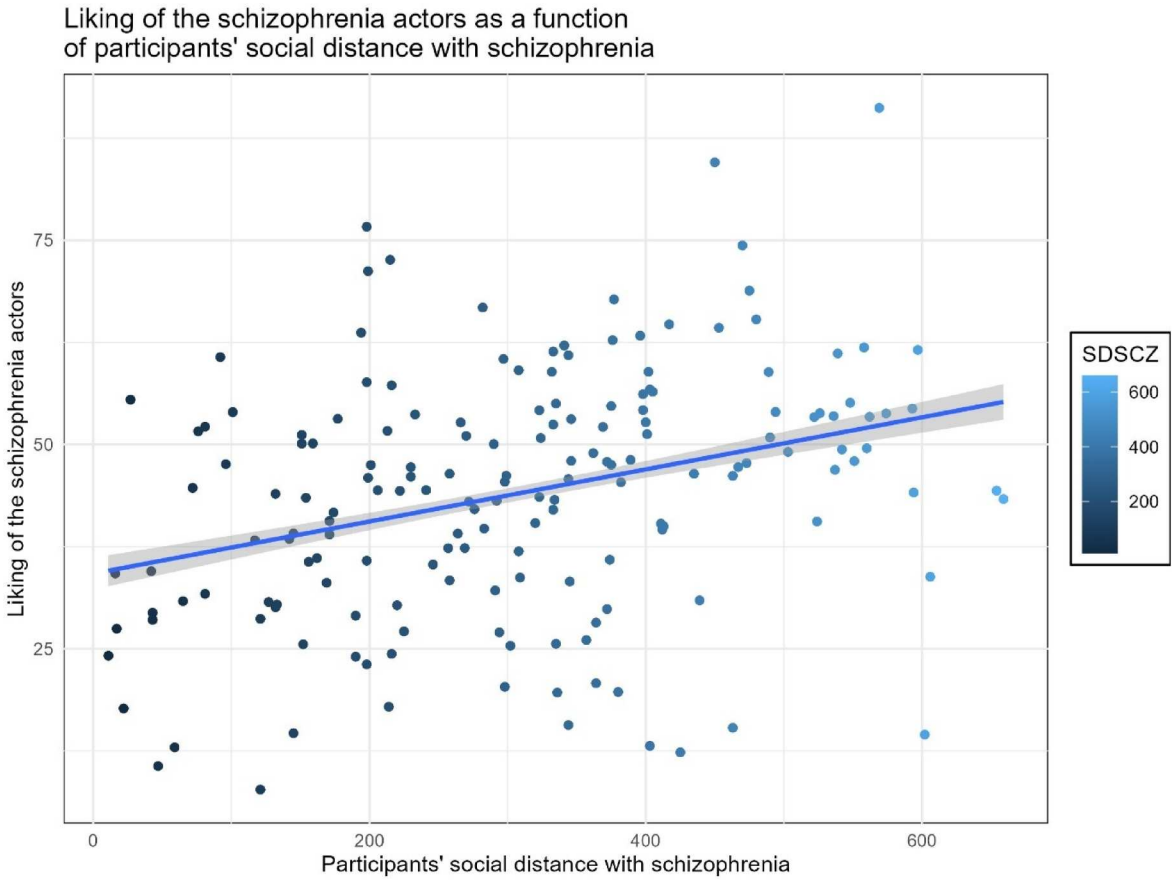

Figure 6. Liking of the schizophrenia actors as a function of participants' social distance with schizophrenia.

Note: liking was assessed on a 100 scale (0 = "not at all", 100 = "a lot") after the question "How much did you like this person?". The social distance scale was computed by adding the scores of seven questions assessed on a 100 scale each (e.g. "How would you feel about having someone diagnosed with schizophrenia as a neighbor?", 0 = "completely disagree" and 100 = "completely agree"). The social distance scores thus ranged from 0 to 700 and a lower score of social distance indicates more willingness to socially distance from individuals with schizophrenia.

(see Figure 6). In addition, the less participants knew about schizophrenia, the less they liked the actors with the "schizophrenia" label.

4. Discussion

We conducted an online experiment to assess liking, interpersonal closeness, and emotional mimicry in response to an actor labelled with one of four labels (schizophrenia, diabetes, healthy, and a negative adjective) who showed either joy or sadness. We also tested whether the influence of the label "schizophrenia" on liking, interpersonal closeness, and emotional mimicry could be explained by participants' explicit stigma (social distance to schizophrenia) and the level of knowledge about schizophrenia. Three main results emerged. First, the label "schizophrenia" impacted negatively on the liking and interpersonal closeness to an individual, thereby confirming H1 and H2. Second, in contrast to liking and interpersonal closeness, the label "schizophrenia" did not affect emotional mimicry, thus H3 was not confirmed. Third, the influence of the label "schizophrenia" on liking was explained by both knowledge about schizophrenia and a measure of explicit stigma (confirming H4 and H5 for liking).

Overall, the results highlight the negative appraisal of actors associated with the label "schizophrenia" compared to other labels. As emphasized in the introduction, stigma is the convergence of four components: a label, negative stereotypes associated with this label, the separation between the ones labelled and the others, and discrimination (Link & Phelan, 2001). In our experiment, we applied a label

to the actors. According to the Link and Phelan model, a stigmatising label is automatically associated with negative stereotypes and beliefs, "directly linking a person to a set of undesirable characteristics" (Link & Phelan, 2001, p. 369). In the case of schizophrenia, these characteristics are danger, incompetence, or unpredictability (Angermeyer & Matschinger, 2003; Wood et al., 2014). In addition, labelled persons are considered distinctly different from general populations, indeed, stigmatised individuals are often thought to be their diagnoses (e.g. calling individuals with a diagnosis of schizophrenia "schizophrenics", Link & Phelan, 2001). Consequently, the finding of decreased liking and interpersonal closeness toward the actors with the label "schizophrenia" compared to other labels, highlights the impact of the stigma associated with schizophrenia. Indeed, significant differences between the "schizophrenia" label and every other label (i.e. the negative adjectives, diabetes, and healthy) for the interpersonal closeness ratings in the joy condition confirmed that participants' response to the schizophrenia label is influenced by stigma, and not a specific medical diagnosis (i.e. diabetes vs schizophrenia), or negative trait (i.e. negative label vs schizophrenia). In addition, in accordance with our fourth hypothesis, liking and interpersonal closeness of the actor with the label schizophrenia was explained by an explicit measure of stigma (i.e. the social distance scale). Consequently, our work corroborates the finding of a heavy implicit and explicit stigmatisation of schizophrenia (Angermeyer & Matschinger, 2003; González-Sanguino et al., 2019; Wood et al., 2014).

Further, participants reported more interpersonal closeness and liking when actors expressed joy rather than sadness. These results are consistent with previous studies (Kastendieck et al., 2021) and the idea that individuals tend to prefer happy faces over sad faces (Liao et al., 2013). Research on first impressions has also shown that faces with positive facial expressions are associated with more approach tendencies and faces with negative facial expressions with more avoidance tendencies (Thierry et al., 2021; Zebrowitz, 2017).

Our third hypothesis concerned the influence of the label "schizophrenia" on emotional mimicry. We hypothesised that participants show reduced emotional mimicry in response to actors depicted as having schizophrenia compared to the other labels **(H3)**. However, even though we found evidence for mimicry, there was no modulation of mimicry by any of the labels. This is somewhat surprising as previous research has shown decreased mimicry of members of outgroups and to disliked others (Bourgeois & Hess, 2008; Likowski et al., 2008; Olszanowski et al., 2022; van der Schalk, Fischer, et al., 2011). There are different explanations for these results.

Sachisthal et al. (2016), conducted a similar experiment to ours to assess the influence of group membership on emotional mimicry. With the same stimuli and an automated coding facial expression analysis, they were also not able to replicate the effect of group membership on emotional mimicry (Sachisthal et al., 2016). To our knowledge, Sachisthal et al. (2016) study is the only other experiment to have assessed group membership influence on emotional mimicry using automated coding software. The majority of other studies have used electromyography or manual coding (Bourgeois & Hess, 2008; Likowski et al., 2008; Olszanowski et al., 2022; van der Schalk, Fischer, et al., 2011). Automated facial expression coding, particularly through the use of OpenFace 2.2, represents a validated and reliable tool (Baltrusaitis et al., 2018). In addition, many studies, including our own, successfully assessed emotional mimicry through the analysis of webcam recordings using OpenFace 2.2 (Kastendieck et al., 2021, 2023; Mauersberger et al., 2022). However, a recent study compared the sensibility of OpenFace to electromyography and concluded that only a large effect could be detected through automated coding (Hsu & Sato, 2023). Consequently, it is possible that while OpenFace is effective in assessing emotional mimicry, it might not be sensitive enough yet to detect the influence of group membership on emotional mimicry. Future studies, employing alternative methodologies such as electromyography, are essential to validate this hypothesis regarding the impact of group membership on emotional mimicry.

However, the diminished sensibility of OpenFace compared to electromyography might not be the sole factor contributing to the lack of influence of stigma on emotional mimicry, especially when compared to its impact on interpersonal closeness and liking. While emotional mimicry is assessed implicitly (i.e. webcam recordings), measures of interpersonal closeness and liking are explicit (i.e. questionnaires). Previous studies have assessed the stigma of mental health diagnoses implicitly and explicitly and did not observe a correlation between these two measurement types (Burguet & Girard, 2023; González-Sanguino et al., 2019; Wang et al., 2012). These

studies found greater stigma according to implicit measures compared to explicit ones (Burguet & Girard, 2023; González-Sanguino et al., 2019; Wang et al., 2012). The explanation given by the authors is that explicit measures are reduced by social desirability bias and denial of stigma (Burguet & Girard, 2023; González-Sanguino et al., 2019; Wang et al., 2012).

In contrast, our study highlighted the impact of schizophrenia stigma on explicit measures (i.e. interpersonal closeness and liking) but not on implicit ones (i.e. emotional mimicry). Even though both implicit and explicit measures reflect stigma, they rely on different components and indicate independent functioning processes (Greenwald et al., 2002; Greenwald & Banaji, 2017). According to Wrobel and Imbir (2019), the influence of the social context on emotional mimicry requires that the receiver has sufficient cognitive capacity and motivation to appraise his/her counterpart. Compared to implicit assessment, answering questionnaires requires more introspection and attentional resources (Wrobel & Imbir, 2019). Consequently, it is plausible that participants did not allocate sufficient cognitive capacity to the label while watching the video, potentially resulting in no discernible effect on emotional mimicry. Conversely, explicit measures of interpersonal closeness and liking demanded heightened attentional resources to the provided labels, thus revealing an influence of stigma. The diminished engagement of participants in the task could be attributed to the within-subject design, potentially making them less attentive to the target characteristics during the video presentation (Sachisthal et al., 2016; Wrobel & Imbir, 2019).

Our final hypothesis was that the influence of the label "schizophrenia" on liking, interpersonal closeness, and mimicry would be explained by explicit stigma **(H4)** and knowledge of schizophrenia **(H5).** These hypotheses are partially validated as explicit stigma and/or knowledge of schizophrenia explained liking and interpersonal closeness of the actors. These results highlight an important implication of our work: the impact of the stigma of schizophrenia on these explicit reactions could be reduced by increasing participants' knowledge of schizophrenia. It is widely acknowledged that the stigma of mental illness is caused by misinformation and negative portrayals in the media (Klin & Lemish, 2008; Perciful & Meyer, 2017; Wahl, 2003). For instance, both adult and child film characters of individuals with schizophrenia are portrayed as dangerous, violent, and aggressive (Wahl, 2003). Consequently, interventions aiming to increase real knowledge of schizophrenia have already been shown to reduce stigma (Compton et al., 2006; Kitchener & Jorm, 2002; Simmons et al., 2017). Recent work also proposed that increasing continuum beliefs of schizophrenia (i.e. considering that schizophrenia is not a distinct entity but rather a collection of symptoms distributed continuously throughout the general population) in the public eye allows a significant reduction of explicit stigma (Thibodeau & Peterson, 2018; Violeau et al., 2020). These interventions are of particular interest in the case of emotional mimicry. Indeed, the objective of continuum beliefs intervention is to increase the feeling of similarity between the general population and individuals with a diagnosis of schizophrenia (Violeau et al., 2020). As emphasized previously, perceived similarity is a strong predictor of emotional mimicry (Bourgeois & Hess, 2008; Peng et al., 2021).

5. Conclusion

In sum, even though our study did not find any effect on mimicry, we were still able to demonstrate that variables linked to emotional mimicry (i.e. liking, interpersonal closeness) were significantly impacted by the label "schizophrenia" compared to other labels. Consequently, our study not only demonstrated the significant impact of the stigmatised label "schizophrenia" but also contributed to existing literature by advocating for interventions. Our findings indeed emphasize the importance of increasing genuine knowledge about schizophrenia to effectively combat stigma. In addition, the impact of the schizophrenia label on antecedent variables of emotional mimicry highlighted a potential effect on emotional mimicry. Consequently, we believe future studies should reconduct our experiment using different methodologies (e.g. electromyography for mimicry measurement) because the lack of results in our study could be explained by the insufficient sensibility of OpenFace 2.2. In addition, exploring the schizophrenia label in a more nuanced manner could be a valuable avenue for future research. For instance, investigating whether people's attitudes, such as liking, are diminished when the label is "medically controlled schizophrenia", where targets are assumed to be receiving appropriate medication, could provide insightful findings. Furthermore, our study exclusively targeted a French population;

hence, future research endeavours should replicate this experiment with a more diverse participant pool.

As emphasized in the introduction, emotional mimicry is of particular importance in the case of schizophrenia stigma. Indeed, a perpetuating circle between emotional mimicry and affiliation could seriously reinforce the social isolation of individuals with schizophrenia who already suffer from social skills deficits. In addition, various studies have already highlighted that induced mimicry could have a positive effect on intergroup interactions. For instance, Hasler and colleagues demonstrated that increased postural mimicry of a virtual human Palestinian interacting with a Jewish Israeli participant led to increased sympathy and interaction quality (Hasler et al., 2014). Consequently, another avenue for future studies is to test our hypotheses in more ecological social interactions to assess the consequences of implicit stigma on perceived social interaction quality as well as the impact of induced emotional mimicry on intergroup interaction quality.

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Author's contributions

MP, SR, LM and PS developed the research idea. MP, TK, HM, US, TF, SR, LM, and PS participated in the development of the methodology. MP collected and analysed the data. MP wrote the original draft, which was extensively reviewed and revised by SR, LM, US, HM, TK and PS.

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ORCID

Mathilde Parisi http://orcid.org/0000-0002-4648-312X
Till Kastendieck http://orcid.org/0000-0001-6675-0144
Heidi Mauersberger http://orcid.org/0000-0001-6743-8654

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