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## The Impact of Mimicry Behavior on Guilt

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**Supplementary Materials:** Code, Data, Materials [see [Index of Supplementary Materials](#)]



### Abstract

Guilt, on the one hand, can be unpleasant and exhausting. On the other hand, it can also motivate individuals to, for example, make amends and repair broken social relationships. To understand this dual nature of guilt, this research turns to the concept of mimicry. Mimicry is defined as the unconscious imitation of behaviors and is widely recognized as a 'social glue' that plays a crucial role in forming and maintaining social relationships. A key question is whether mimicry could serve as an appliance for the sake of guilt release. A series of six studies (N = 414) reveals the opposite pattern: participants who were mimicked (compared to non-mimicked) felt more guilty. This outcome suggests that while mimicry generally fosters social connections, its interplay with emotions like guilt can be complex.

### Keywords

mimicry, chameleon effect, guilt, mini-meta-analysis



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## Highlights

- Guilt can be both unpleasant and motivating, leading people to repair social relationships.
- Mimicry, which acts like a social glue, is tested as a potential tool for the sake of guilt release.
- Six studies found that mimicked participants felt more guilty.
- This unexpected finding contributes to the understanding of the dynamics of mimicry and guilt.

Guilt, due to its complex and pervasive nature in the human experience, has been extensively studied in psychology. Specifically, researchers have delved into how guilt arises when a person believes they violated an internalized moral or ethical norm and feels responsible for their actions (e.g., [Tangney et al., 2007](#)). This emotion affects a person's well-being, leading to increased anxiety (e.g., [Ranganadhan & Todorov, 2010](#)), self-punishment (e.g., [Tanaka et al., 2015](#)), and depression, while decreasing motivation (e.g., [Haran, 2019](#)) and self-esteem (e.g., [Tennen & Herzberger, 1987](#)).

However, other research reports that guilt is a double-edged sword, as it also leads to positive outcomes, serving as a driver of social bonding and integration. This perspective is particularly evident in [Baumeister et al.'s \(1994\)](#) work, which provides substantial evidence supporting these claims. The authors hypothesize that guilt serves as a signal that a person has violated a social norm or expectation. Thus, guilt can prompt individuals to take responsibility for the harm they have caused and motivate them to repair any damage (e.g., [O'Malley & Greenberg, 1983](#)). This emotion can also lead to a desire to improve damaged relationships by promoting cooperation and forgiveness, further emphasizing its role in social dynamics signaling to others that we value the relationship and are committed to making amends for our actions or at least to apologize ([Friedman, 1985](#); [Hoffman, 1982](#); [Lewis, 1971](#); [Zahn-Waxler & Kochanska, 1990](#), as cited in [Baumeister et al., 1994](#), p. 257).

What is more, guilt can also enhance the motivation to rectify past errors and prevent future ones ([Flynn & Schaumberg, 2012](#)). It also promotes moral reasoning and decisions—highlighting its importance in ethical considerations, by leading people to consider the ethical implications of their actions and prompting them to make decisions that are consistent with their values and beliefs (e.g., [Tangney et al., 2007](#)). Finally, guilt also increases individuals' willingness to engage in helpful behavior, such as volunteering or donating to charity ([Basil et al., 2008](#)) by promoting cooperation, fairness, and honesty ([Ketelaar & Au, 2003](#)).

Guilt, as mentioned above, has a dual nature: it can cause negative effects like reduced self-esteem (e.g., [Tennen & Herzberger, 1987](#)), yet it also strengthens connectiveness in cooperative interactions, thereby enhancing interpersonal relationships and

social bonds (for a review, see Baumeister et al., 1994). However, despite guilt's positive aspects, the continued search for effective coping mechanisms is essential due to its many negative outcomes. Effective coping methods with guilt can enable its positive aspects, fostering personal growth and improved relationships (e.g., Baumeister et al., 1994). In this context, mimicry (e.g., Chartrand & Bargh, 1999), a crucial phenomenon in the formation and maintenance of social relationships (Dijksterhuis, 2005; Lakin et al., 2003), could be a valuable tool to alleviate guilt by fostering social bonds and a sense of belonging.

## Mimicry as a Social Glue

The “chameleon effect” phenomenon (Chartrand & Bargh, 1999) denotes the unconscious mimicry of behaviors, encompassing nonverbal behaviors (e.g., Cracco et al., 2018), speech characteristics (e.g., Cappella & Planalp, 1981), emotions (e.g., Neumann & Strack, 2000), and facial expressions (e.g., Lundqvist & Dimberg, 1995).

This imitating behavior is explained by the perception behavior link theory (e.g., Chartrand & Bargh, 1999; Prinz, 1997). This theory argues that seeing someone engaged in a behavior activates that behavioral representation, which, in return, leads the perceiver to engage himself or herself in that behavior. The mimicry as a social glue hypothesis (Dijksterhuis, 2005; Lakin et al., 2003) proposes that the reason behind this effect can be attributed to the shared characteristic of mimicry, which benefits both individuals involved in the behavior and strengthens their social bond.

For example, mimicry is deployed to build affiliation (Chartrand & Bargh, 1999; Lakin et al., 2003), and at the same time leads to a positive evaluation of the mimicker (e.g., Chartrand & Bargh, 1999; Muniak et al., 2021). In the same vein, mimicry can be modulated by a wide range of social cues, including group membership (e.g., Bourgeois & Hess, 2008), motivation to affiliate (e.g., Lakin et al., 2008). Given the wide range of presented findings, it is not surprising that mimicry has been referred to as a social glue that brings people together (Dijksterhuis, 2005; Lakin et al., 2003).

## The Link Between Mimicry and Guilt

Martin et al.'s (2010) study establishes a connection between mimicry and the emotion of guilt. In this study, confederates accidentally bumped into participants. Depending on the condition, the confederate either blamed the participant (guilt condition) or took responsibility for the collision (no guilt condition). This setup was intended to trigger feelings of guilt. Following this initial interaction, the study's procedure continued with the participants watching a video alone in a room. The video featured a woman touching and rubbing her face. During this viewing, a webcam discreetly recorded the participants' behavior. In the final step of this experiment, the researchers asked the participants to answer several questions about their feelings of guilt.

The results of this experiment showed that the participants in the guilt condition mimicked the person shown on the video significantly more often than the participants in the no guilt condition. Moreover, the extent of mimicry was correlated with the level of guilt, but only in the guilt condition. This finding suggests that mimicry might serve as a mechanism for creating affiliation and rapport, particularly in contexts where individuals feel guilty.

It should be emphasized here that the [Martin et al. \(2010\)](#) study focused exclusively on mimicry in a controlled environment, in which participants' mimicry was directed at the person depicted in a video and not at those involved in the guilt-inducing incident. This raises an important question: Is the increased frequency of mimicry observed in participants experiencing guilt also detectable in interactions with the person involved in the event that triggered their guilt? The question of how mimicry operates in real-time interactions with those who triggered the guilt remains a largely uncharted area.

Another point that should be highlighted is that in the [Martin et al. \(2010\)](#) study, the researchers only asked about the frequency of mimicry performed by participants who felt guilty. However, to gain deeper insight into the relationship between mimicry and guilt, it is essential to explore the reverse effect – specifically, how being mimicked influences feelings of guilt. This research direction is warranted because mimicry serves an important role as a social glue phenomenon ([Dijksterhuis, 2005](#); [Lakin et al., 2003](#)). On the one hand, research shows that mimicry creates liking (e.g., [Chartrand & Bargh, 1999](#); [Muniak et al., 2021](#)) as well as trust ([Swaab et al., 2011](#)) and promotes a more other-oriented perspective ([Ashton-James et al., 2007](#)). Conversely, those who are socially excluded use mimicry directly to re-establish social relationships ([Lakin et al., 2008](#)). Furthermore, interactions without mimicry are associated with increased stress ([Kouzakova et al., 2010](#)) and feelings of physical coldness ([Leander et al., 2012](#)). This means that mimicry should act as a social glue when guilt is present to alleviate or eliminate feelings of guilt in the interaction. Thus, if participants who are mimicked report a decrease in guilt, it would imply a bidirectional relationship. This would suggest that mimicry not only mirrors emotional states, as demonstrated by [Martin et al. \(2010\)](#) in facilitating the repair of strained social relationships, but it also plays a role in regulating these emotions, potentially aiding in the alleviation of guilt.

## Hypothesis Development

As outlined above, establishing an effective technique for removing feelings of guilt would be particularly beneficial for social relationships. Such a technique could potentially serve as a coping tool for releasing individuals from negative outcomes stemming from this emotion, such as anxiety or depression (e.g., [Haran, 2019](#); [Ranganadhan & Todorov, 2010](#); [Tanaka et al., 2015](#); [Tennen & Herzberger, 1987](#)). One should remember that the maintenance of social relations is a crucial mechanism of guilt (e.g., [Baumeister](#)

et al., 1994). This social relations maintenance mechanism falls within the realm of another mechanism, namely mimicry.

Mimicry has been established as extremely positive in terms of building and maintaining social relationships (e.g., Chartrand & Bargh, 1999) even in the context of experiencing guilt (Martin et al., 2010). Based on an understanding of the 'chameleon effect' and the assumption that mimicry acts as a social glue (Dijksterhuis, 2005; Lakin et al., 2003), we hypothesize that mimicry should reduce guilt by activating a sense of belonging (Chartrand & Bargh, 1999; Lakin et al., 2003), which may offer an emotional boost that can erase the bad feelings associated with guilt (Cunningham, 1980, as cited in Baumeister et al., 1994, p. 256), and consequently lead to this emotion being alleviated.

## Present Study

In contrast to the initial study by Martin et al. (2010), which established a link between mimicry and feelings of guilt, our study takes a new approach. Whereas Martin et al. (2010) investigated the frequency of mimicry performed by participants who felt guilty in relation to someone who was not involved in the guilt-inducing event, our study examines the reverse situation. We focus on the effects of mimicking participants who felt guilt over a person who was present at the guilt-inducing event. This approach aims to understand the impact of mimicry on participants' feelings of guilt and its potential role in mitigating these feelings. To thoroughly investigate these reverse dynamics, we conducted six exploratory studies. Each study was designed to identify effective mimicry strategies that could alleviate feelings of guilt in different contexts.

This strategy aimed to determine the best approach for a more extensive, application-oriented study in natural settings. In this context, participants underwent different guilt inductions—direct and autobiographical recall—and were then subjected to various mimicry types. Study 1a, along with Study 1b, examined nonverbal mimicry with direct guilt induction (Study 1a) and autobiographical recall (Study 1b). Subsequent studies, 2a and 2b, explored verbal mimicry in similar contexts, and Studies 3a and 3b combined both mimicry types with each guilt induction method. This structured approach allowed us to methodically analyze and compare the effects across different conditions, laying the groundwork for the more detailed future investigations.

## General Methods

### Sample

In our research exploring the guilt-mimicry dynamic, we conducted a series of six studies, each meticulously planned to provide insights into how different types of mimicry influence guilt perception. The sample size for each study was determined based on the falsifiability criteria outlined by Lakens (2022), ensuring that our methodology could

reliably detect the smallest possible effect size. We recruited as many participants as possible within the constraints of the research panel and adhered to practical and ethical standards (Lakens & Evers, 2014). Recruitment ceased when new enrollments stopped.

Our participant pool consisted of students from two universities in large Polish cities (Poznan and Warsaw), all Polish-speaking and presumably residing in Poland. They registered independently through the SONA system, with many being older students in weekend courses. To preserve the integrity of the research, we ensured that no participant took part in more than one experiment. This structured and sequential approach, spanning two years, aimed to build a comprehensive understanding of the relationship between guilt and mimicry, laying the groundwork for future, more extensive research projects.

## Measures

Regardless of the study, each participant was asked to fill in the scale of guilt (Wojciszke & Baryła, 2005)<sup>1</sup> by indicating their agreement (1 = *strongly disagree*; 7 = *strongly agree*). This scale consists of four categories (shame, humiliation, regret, and guilt). Nothing had to be reverse coded. The result was the average score of these four components. Cronbach's  $\alpha$  of this scale was  $\alpha = .75$ . The measurement of guilt was uniformly applied across all six studies and was conducted only after the completion of the experimental procedures.

## Statistical Analysis and Open Practices

Protocols from the performed analyses, along with databases and reports are accessible at the Open Science Framework (see Muniak, 2022). Experiments were approved by the local ethics committee (opinion number: 31/2019). Informed consent was obtained from all participants before enrollment in the experimental procedures and data collection. After the procedures were complete, the participants were properly debriefed following the ethics committee suggestions.

The R programming language implemented in RStudio<sup>2</sup> was used to conduct the analysis. The normality of the distribution of the analyzed parameters was assessed using the Shapiro–Wilk test. Normality tests along with descriptive statistics were calculated and reported for each study separately within the experimental groups (see Table 1).

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1) See Muniak (2022, <https://osf.io/97fkd>).

2) A complete database along with R codes can be accessed on the OSF within the "R Codes and Data" folder (see Muniak, 2022).

**Table 1**

*Descriptive Statistics for Guilt Avg. Indicator in All Studies*

Study name	Guilt method	Mimicry method	Condition	M	SD	Me	Mo	Min.	Max.	Sk.	Shapiro-Wilk test		
											Kurt.	S-W	p
Study 1a	Direct guilt induction	Nonverbal	Mimicry	2.60	1.53	2.0	1.0	1.0	6.25	0.87	2.71	.88	.003
			No mimicry	1.77	1.18	1.25	1.0	1.00	5.50	1.92	5.89	.69	< .001
Study 1b	Autobiographical recall	Nonverbal	Mimicry	4.77	1.82	5.00	7.00	1.25	7.00	-0.23	1.72	.91	.011
			No mimicry	3.94	1.15	4.00	4.25	2.00	6.50	0.06	2.52	.97	.469
Study 2a	Direct guilt induction	Verbal	Mimicry	4.55	1.92	5.00	6.00	1.00	7.00	-0.48	2.03	.91	.044
			No mimicry	3.41	1.56	3.50	4.00	1.00	6.00	0.21	2.00	.92	.078
Study 2b	Autobiographical recall	Verbal	Mimicry	5.23	1.42	5.50	5.50	1.00	7.00	-1.01	3.74	.92	.002
			No mimicry	4.66	1.51	4.88	6.50	1.50	6.75	-0.47	2.20	.94	.014
Study 3a	Direct guilt induction	Mixed	Mimicry	4.18	0.96	4.38	4.50	2.75	5.75	-0.06	1.79	.93	.049
			No mimicry	3.99	0.99	4.38	4.50	1.75	5.50	-0.69	2.63	.93	.056
Study 3b	Autobiographical recall	Mixed	Mimicry	4.24	0.99	4.25	4.00	2.25	7.00	0.24	2.97	.98	.734
			No mimicry	3.89	1.06	4.00	4.50	1.75	6.25	-0.07	2.97	.98	.776

After analyzing the descriptive statistics, including skewness and kurtosis, we decided to perform further analyses using Student's *t* test for independent samples. To assess the probability that our results would occur if the null hypothesis ( $H_0$ ) was true, the analysis was enriched with a Bayesian *t*-test for independent samples. Additionally, we complemented each *t*-test with a sensitivity power analysis. This analysis assumed a significance level of .05 for a two-tailed test. Its purpose was to strengthen the robustness of our results by quantifying the power to detect an effect of a specified size.

## Study 1a

### Method

#### Participants and Design

Sixty local university students (of which 41 identified as women, and 19 as men) ranging in age from 19 to 46 ( $M_{\text{age}} = 26.72$ ,  $SD_{\text{age}} = 6.05$ ) participated in the experiment. Five participants were excluded from the analysis due to missing answers ( $n = 2$ ) and perturbation caused by the experimental procedure ( $n = 3$ ). The final sample consisted of  $N = 55$  participants (of which 38 identified as women, and 17 as men) ranging in age from 19 to 46 ( $M_{\text{age}} = 26.67$ ,  $SD_{\text{age}} = 6.25$ ). Participants were randomly assigned to one of two between-subject conditions: nonverbal mimicry ( $n = 30$ ) and no-mimicry conditions. Participants received course credit for their participation. We collected data from as many participants as possible during the academic year in which the study was run.

#### Procedure

Participants, upon arriving at the laboratory, read an informed consent form. The document clearly stated that participation in the experiment could result in experiencing unpleasant emotional states. Subsequently, the participants were subjected to an experimental induction of guilt. In Study 1 we used a paradigm of direct approach of inducing guilt (e.g., Kelln & Ellard, 1999; Muniak & Kulesza, 2020). We asked participants to carefully follow the instructions on the screen while completing the questionnaire about socio-political beliefs and opinions<sup>3</sup>. Additionally, participants were informed that skipping one question could generate a critical error<sup>4</sup>. However, the error appeared automatically after the 49th from 75 questions—regardless of the participants' actions—suggesting that, due to a mistake by the participants, the experimenter had lost his work.

After this incident, the experimenter (female in her early twenties, blind to the hypothesis and having received only manipulation and randomization instructions) left

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3) See Muniak (2022, <https://osf.io/5stzj>).

4) See Muniak (2022, <https://osf.io/yhmkz>).



the laboratory under the pretext of consulting and fixing an error. She then returned to the laboratory after 5 minutes, informing participants that unfortunately the error was irreversible, and she had lost 19 surveys. After this information, the participants were asked if they would like to participate in another study conducted by the experimenter.

Participants were explicitly informed that the next study was a separate study, and they were given the opportunity to participate if they wanted to. This study involved a 10-minute interview about participants' attitudes and beliefs concerning the education system in the country where the study was conducted<sup>5</sup>. During the interview, the confederate nonverbally mimicked (or not) participants. In the mimicry condition, the experimenter copied the participants' behaviors, such as hand gestures, arm movements, and body position. In the non-mimicry condition, the experimenter sat still and straight with both hands on his lap and both feet on the ground (e.g., Chartrand & Bargh, 1999; Muniak et al., 2021).

After the interview, participants completed a questionnaire measuring guilt (Wojciszke & Baryła, 2005). This measurement occurred only at the end of the experimental procedure. After that, participants were asked whether they had any ideas about the study hypothesis, as well as whether they were aware that confederates were copying their gestures/body movements. At the end, participants were thanked and debriefed, and awarded credit points for their participation.

## Results

To assess the differences between participants who were nonverbally mimicked and those who were not mimicked in terms of reported levels of directly elicited guilt, we conducted an independent-samples *t*-test. The analysis revealed that participants who experienced nonverbal mimicry reported significantly higher levels of guilt than those who did not,  $t(53) = 2.22, p = .031$ , Cohen's  $d = 0.60, SE = 0.28, 95\% CI [0.06, 1.14]$ . For descriptive statistics, see Table 1, and for a visual representation of these data, refer to Figure 1.

With a Bayes factor of  $BF_{01} = 0.50$ , this result can be considered “anecdotal” evidence for  $H_1$  (Wagenmakers et al., 2011). A sensitivity analysis shows that with our sample size, a power of 80% was achieved for an effect size of Cohen's  $d = 0.78$ . This suggests that although the study was sufficiently powered to detect the observed effect size (Cohen's  $d = 0.60$ ), it was originally optimized to detect somewhat larger effects. Please see Figure 2.

The study revealed that nonverbal mimicry significantly increased feelings of guilt, diverging from our initial hypotheses. The next study will test the generality of this effect using a different type of guilt induction, namely autobiographical recall.

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5) See Muniak (2022, <https://osf.io/nts6h>).

## Study 1b

### Method

#### Participants and Design

Seventy local university students (of which 53 identified as women, and 17 as men) ranging in age from 18 to 53 ( $M_{\text{age}} = 25.99$ ,  $SD_{\text{age}} = 7.75$ ) participated in the experiment. Eight participants were excluded from the analysis since they indicated a correct study hypothesis ( $n = 2$ ), resigned from participation in the experiment ( $n = 2$ ), and due to perturbation caused by the experimental procedure ( $n = 4$ ). The final sample consisted of  $N = 62$  local university students (of which 48 identified as women, and 14 as men) ranging in age from 18 to 53 ( $M_{\text{age}} = 26.05$ ,  $SD_{\text{age}} = 8.20$ ). Participants were randomly assigned to one of two between-subject conditions: nonverbal mimicry ( $n = 31$ ) and no-mimicry ( $n = 31$ ) conditions. Participants received course credit for their participation. We collected data from as many participants as possible during the academic year in which the study was run.

#### Procedure

Participants, upon arriving at the laboratory, read an informed consent form. The document clearly stated that participation in the experiment could result in experiencing unpleasant emotional states. Subsequently, the participants were subjected to an experimental induction of guilt. In this study, we used a paradigm of autobiographical recall. At the beginning of the procedure the experimenter (a male in his early twenties, blind to the hypothesis and having received only manipulation and randomization instructions) asked participants to recall in detail an event from their recent past in which they had felt and experienced guilt (e.g., Nelissen et al., 2007). Subsequently, the participants were asked to think about this event and write about it in a few sentences<sup>6</sup>.

When the participant finished, the experimenter informed the participants that the experiment was complete, and they were asked whether they would like to participate in another study conducted by the experimenter. Participants were explicitly informed that the next study would be a separate study, and they were given the opportunity to participate. As in Study 1a, this study involved a 10-minute interview about participants' attitudes and beliefs concerning the education system in Poland (the country where the study was conducted).

During the interview, the confederate nonverbally mimicked (or not) participants following the same methodology as in Study 1 which was in the mimicry condition, the confederate copied the participants' behaviors, such as hand gestures, arm movements,

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6) See Muniak (2022, <https://osf.io/snh6x>).

To evaluate the efficacy of this method, we conducted a pilot study. Detailed descriptions of our findings can be found at this link: <https://osf.io/6rj8e/>

and body position. In the non-mimicry condition, the confederate sat still and straight with both hands on his lap and both feet on the ground (e.g., Chartrand & Bargh, 1999; Muniak et al., 2021).

After the interview, participants completed a questionnaire measuring guilt (Wojciszke & Baryła, 2005). This measurement occurred only at the end of the experimental procedure. After that, participants were asked whether they had any ideas about the study hypothesis and whether they were aware that confederates were copying their gestures/body movements. At the end, participants were thanked, debriefed, and awarded credit points for their participation.

## Results

To assess the differences between participants who were nonverbally mimicked and those who were not mimicked in terms of reported levels of guilt induced by autobiographical recall, we conducted an independent-samples *t*-test. The analysis revealed that participants who experienced nonverbal mimicry reported significantly higher levels of guilt than those who did not,  $t(60) = 2.16$ ,  $p = .034$ , Cohen's  $d = 0.55$ ,  $SE = 0.26$ , 95% CI [0.04, 1.06]. For descriptive statistics, see Table 1, and for a visual representation of these data, refer to Figure 1.

With a Bayes factor of  $BF_{01} = 0.55$ , this result can be considered “anecdotal” evidence for  $H_1$  (Wagenmakers et al., 2011). A sensitivity analysis shows that with our sample size, a power of 80% was achieved for an effect size of Cohen's  $d = 0.74$ . This suggests that although the study was sufficiently powered to detect the observed effect size (Cohen's  $d = 0.55$ ), it was originally optimized to detect somewhat larger effects. Please see Figure 2.

Study 1b's results aligned with those of Study 1a, showing that participants who were nonverbally mimicked felt significantly more guilt, even after the autobiographical recall guilt induction method.

## Discussion

Studies 1a and 1b revealed an unexpected pattern: participants who were nonverbally mimicked experienced heightened guilt, regardless of whether it was directly induced (Study 1a) or triggered by autobiographical recall (Study 1b). This suggests the effect is consistent across different guilt induction methods. To further investigate, the subsequent studies (Study 2a and 2b) will assess the influence of verbal mimicry on guilt, both directly induced and via autobiographical recall, offering deeper insights into the dynamics of mimicry and guilt.

## Study 2a

### Method

#### Participants and Design

Fifty local university students (of which 28 identified as women, and 22 as men) ranging in age from 18 to 55 ( $M_{\text{age}} = 35.56$ ,  $SD_{\text{age}} = 9.37$ ) participated in the experiment. Six participants were excluded from the analysis since they indicated a correct study hypothesis ( $n = 1$ ), resigned from participation in the experiment ( $n = 1$ ), or due to perturbation caused by the experimental procedure ( $n = 4$ ). The final sample consisted of  $N = 44$  local university students (of which 23 identified as women, and 21 as men) ranging in age from 18 to 55 ( $M_{\text{age}} = 36.30$ ,  $SD_{\text{age}} = 9.71$ ). Participants were randomly assigned to one of two between-subject conditions: verbal mimicry ( $n = 22$ ) and no-mimicry ( $n = 22$ ) conditions. Participants received course credit for their participation. We collected data from as many participants as possible during the academic year in which the study was run.

#### Procedure

The procedure of this experiment was similar to Study 1a, meaning that upon arrival at the laboratory, participants were subjected to a direct guilt induction manipulation (they were informed that they had made a mistake which nullified the experimenter's work), followed by an introduction to mimicry manipulation. However, this time the procedure differed as it utilized what is known as verbal mimicry. This meant that during the interview (which used the same questions as in previous studies), the confederate either verbally mimicked the participants or did not.

In the mimicry condition, the confederate copied the statements, paraphrased, and adopted the participants' tone of voice. In the non-mimicry condition, the confederate summed up the statements with simple words like "okay" (Muniak et al., 2021; van Baaren et al., 2003). After this, participants were asked to complete a questionnaire, and as in previous studies, they were thanked, asked for their hypotheses about the study, and then debriefed.

### Results

To assess the differences between participants who were verbally mimicked and those who were not mimicked in terms of reported levels of directly elicited guilt, we conducted an independent-samples *t*-test. The analysis revealed that participants who experienced verbal mimicry reported significantly higher levels of guilt than those who did not,  $t(42) = 2.15$ ,  $p = .037$ , Cohen's  $d = 0.65$ ,  $SE = 0.31$ , 95% CI [0.04, 1.25]. For descriptive statistics, see Table 1, and for a visual representation of these data, refer to Figure 1.

With a Bayes factor of  $BF_{01} = 0.55$ , this result can be considered “anecdotal” evidence for  $H_1$  (Wagenmakers et al., 2011). A sensitivity analysis shows that with our sample size, a power of 80% was achieved for an effect size of Cohen’s  $d = 0.88$ . This suggests that although the study was sufficiently powered to detect the observed effect size (Cohen’s  $d = 0.66$ ), it was originally optimized to detect somewhat larger effects. Please see Figure 2.

Study 2a once again demonstrated that directly induced feelings of guilt were higher in participants who were mimicked, this time verbally. Continuing this line of research, the subsequent study, 2b, will test whether this effect can be observed again after inducing guilt through the method of autobiographical recall.

## Study 2b

### Method

#### Participants and Design

One hundred local university students (of which 56 identified as women, and 44 as men) ranging in age from 18 to 54 ( $M_{\text{age}} = 24.55$ ,  $SD_{\text{age}} = 7.52$ ) participated in the experiment. No participants were removed from the analysis. Participants were randomly assigned to one of two between-subject conditions: verbal mimicry ( $n = 50$ ) and no-mimicry ( $n = 50$ ) conditions. Participants received course credit for their participation. We collected data from as many participants as possible during the academic year in which the study was run.

#### Procedure

The procedure of this experiment was similar to Study 1b, meaning that upon arrival at the laboratory, participants were subjected to autobiographical guilt induction manipulation (participants were asked to recall an event from their past when they felt guilty and to write about it in a few sentences), followed by an introduction to mimicry manipulation. However, this time the procedure differed as it utilized verbal mimicry. This meant that during the interview (which used the same questions as in previous studies), the confederate either verbally mimicked the participants or did not. The mimicry condition was identical to study 2a in that the confederate copied participants’ statements, paraphrased them, and adopted their tone of voice. In the non-mimicry condition, the confederate summed up the statements with simple words like “okay” (Muniak et al., 2021; van Baaren et al., 2003). After this, participants were asked to complete a questionnaire, and as in previous studies, they were thanked, asked for their hypotheses about the study, and then debriefed.

## Results

To assess the differences between participants who were verbally mimicked and those who were not mimicked in terms of reported levels of guilt induced by autobiographical recall, we conducted an independent-samples *t*-test. The analysis revealed that participants who experienced verbal mimicry reported descriptively higher levels of guilt than those who did not, but this difference did not reach statistical significance,  $t(98) = 1.96$ ,  $p = .053$ , Cohen's  $d = 0.39$ ,  $SE = 0.20$ , 95% CI [-0.01, 0.79]. For descriptive statistics, see Table 1, and for a visual representation of these data, refer to Figure 1.

With a Bayes factor of  $BF_{01} = 0.88$ , this result can be considered “anecdotal” evidence for  $H_1$  (Wagenmakers et al., 2011). A sensitivity analysis shows that with our sample size, a power of 80% was achieved for an effect size of Cohen's  $d = 0.58$ . This suggests that although the study was sufficiently powered to detect the observed effect size (Cohen's  $d = 0.39$ ), it was originally optimized to detect somewhat larger effects. Please see Figure 2.

Study 2b confirmed the pattern observed in all previous studies: participants who were verbally mimicked reported descriptively higher levels of guilt compared to those who were not. However, this difference did not reach statistical significance.

## Discussion

Studies 2a and 2b showed that verbal mimicry also increased guilt in participants, whether induced directly or through autobiographical recall. The next studies, 3a and 3b, will explore the effects of mixed mimicry—combining verbal and nonverbal mimicry techniques.

## Study 3a

### Method

#### Participants and Design

Sixty local university students (of which 36 identified as women, and 24 as men) ranging in age from 18 to 54 ( $M_{\text{age}} = 36.53$ ,  $SD_{\text{age}} = 10.55$ ) participated in the experiment. No participants were removed from the analysis. Participants were randomly assigned to one of two between-subject conditions: no-mimicry ( $n = 30$ ) and mixed mimicry ( $n = 30$ ) conditions. Participants received course credit for their participation. We collected data from as many participants as possible during the academic year in which the study was run.

#### Procedure

The procedure of this experiment was similar to Study 1a and 2a, meaning that upon arrival at the laboratory, participants were subjected to a direct guilt induction manipu-

lation (they were informed that they had made a mistake which nullified the experimenter's work), followed by an introduction to mimicry manipulation. However, this time the procedure differed as it utilized what is known as mixed mimicry (e.g., Kulesza et al., 2023). This meant that during the interview (which used the same questions as in previous studies), the confederate either verbally mimicked the participants or did not.

In the mimicry condition, the confederate simultaneously mimicked the participants, both verbally and nonverbally. This included mirroring their statements, paraphrasing, and adopting similar tones of voice, as well as replicating their physical behaviors such as hand gestures, arm movements, and body postures. Conversely, in the non-mimicry condition, the confederate responded minimally, using brief affirmations like “okay”, and maintained a still, upright posture with both hands resting on their lap and their feet planted firmly on the ground. Following these interactions, participants were asked to fill out a questionnaire. Consistent with previous studies, participants were then thanked, queried about their hypotheses regarding the study's purpose, and subsequently debriefed.

## Results

To assess the differences between participants who were mimicked both verbally and nonverbally and those who were not mimicked in terms of reported levels of directly elicited guilt, we conducted an independent-samples *t*-test. The analysis revealed that participants who experienced mixed mimicry reported the same level of guilt as those who did not,  $t(58) = 0.76$ ,  $p = .449$ , Cohen's  $d = 0.20$ ,  $SE = 0.26$ , 95% CI [-0.31, 0.70]. For descriptive statistics, see Table 1, and for a visual representation of these data, refer to Figure 1.

With a Bayes factor of  $BF_{01} = 2.98$ , this result can be considered “anecdotal” evidence for  $H_0$  (Wagenmakers et al., 2011). A sensitivity analysis shows that with our sample size, a power of 80% was achieved for an effect size of Cohen's  $d = 0.74$ . This suggests that although the study was sufficiently powered to detect the observed effect size (Cohen's  $d = 0.20$ ), it was originally optimized to detect somewhat larger effects. Please see Figure 2.

In study 3a, no significant impact of mixed mimicry on directly induced feelings of guilt was observed. The next and final study, 3b, will test the influence of mixed mimicry on guilt induced through autobiographical recall.

## Study 3b

### Method

#### Participants and Design

One hundred local university students (of which 52 identified as women, and 48 as men) ranging in age from 18 to 55 ( $M_{\text{age}} = 35.11$ ,  $SD_{\text{age}} = 11.82$ ) participated in the experiment.

Seven participants were excluded from the analysis since they indicated a correct study hypothesis ( $n = 2$ ), resigned from participation in the experiment ( $n = 2$ ), or due to perturbation caused by the experimental procedure ( $n = 3$ ). The final sample consisted of  $N = 93$  local university students (of which 50 identified as women, and 43 as men) ranging in age from 18 to 55 ( $M_{\text{age}} = 36.15$ ,  $SD_{\text{age}} = 11.60$ ). Participants were randomly assigned to one of two between-subject conditions: no-mimicry ( $n = 46$ ) and mixed mimicry ( $n = 47$ ) conditions. Participants received course credit for their participation. We collected data from as many participants as possible during the academic year in which the study was run.

## Procedure

The experiment's procedure mirrored that of Studies 1b and 2b: participants, upon arriving at the laboratory, underwent an autobiographical guilt induction (recalling and writing about a past event where they felt guilty), followed by an introduction to mimicry manipulation. However, this experiment differed by employing mixed mimicry, as in the case of Study 3a. Which means that in the mimicry condition, the confederate simultaneously mimicked participants both verbally and nonverbally, encompassing behaviors such as mirroring statements, paraphrasing, adopting voice tones, and imitating physical gestures like hand and arm movements. In contrast, the non-mimicry condition saw the confederate providing minimal responses, such as "okay," and maintaining a motionless, upright posture. After these interactions, participants completed a questionnaire, were thanked, asked about their study hypotheses, and debriefed, aligning with the procedures of previous studies.

## Results

To assess the differences between participants who were mimicked both verbally and nonverbally and those who were not mimicked in terms of guilt induced by autobiographical recall, we conducted an independent-samples  $t$ -test. The analysis revealed that participants who experienced mixed mimicry reported the same level of guilt as those who did not,  $t(91) = 1.63$ ,  $p = .106$ , Cohen's  $d = 0.34$ ,  $SE = 0.21$ , 95% CI [-0.07, 0.75]. For descriptive statistics, see Table 1, and for a visual representation of these data, refer to Figure 1.

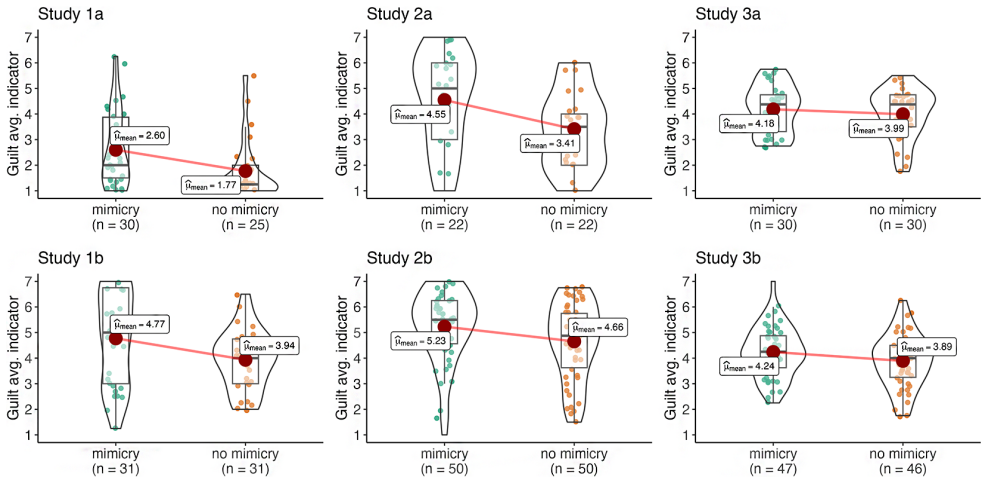
With a Bayes factor of  $BF_{01} = 1.43$ , this result can be considered "anecdotal" evidence for  $H_0$  (Wagenmakers et al., 2011). A sensitivity analysis shows that with our sample size, a power of 80% was achieved for an effect size of Cohen's  $d = 0.60$ . This suggests that although the study was sufficiently powered to detect the observed effect size (Cohen's  $d = 0.34$ ), it was originally optimized to detect somewhat larger effects. Please see Figure 2.

The final study, 3b, again showed that mixed mimicry did not influence the sense of guilt, this time when induced through autobiographical recall.



**Figure 1**

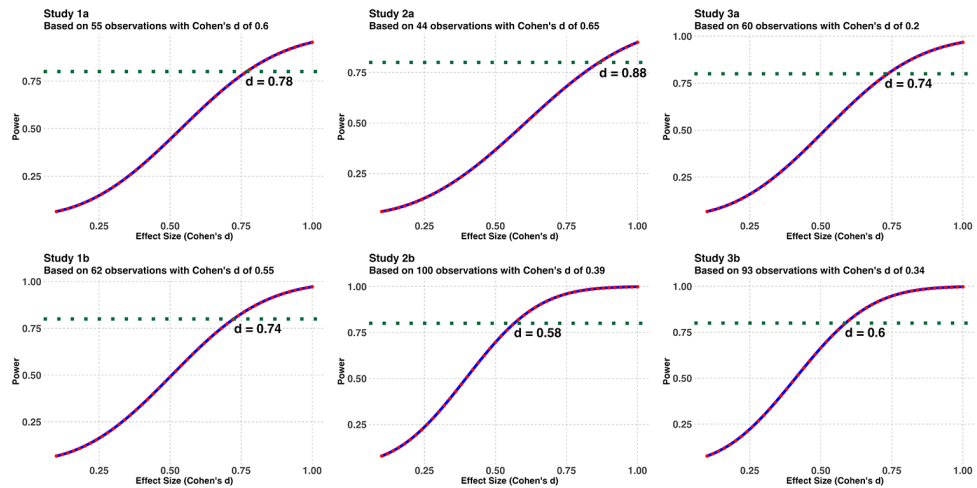
*Violin Plots – Distribution of Guilt Avg. Indicator in Mimicry (Left Panel) and No Mimicry (Right Panel) Conditions in k = 6 Studies*



*Note.* Red dot represents the mean value. Green and orange dots represent single observations (jittered).

**Figure 2**

*Results of Sensitivity Analysis for all Six Studies*



*Note.* Lines present estimated power (Y-axis) at the given Cohen’s d (X-axis). The blue line shows the relationship between effect size and statistical power, while the green dotted line marks the standard power threshold of 0.80. Red points indicate calculated power values for specific effect sizes.

## Discussion

Although we evaluated each study individually, the collective pattern of results did not present a coherent picture. The individual studies presented varied results: three contradicted our initial hypotheses, while others showed no significant effects. This inconsistency and the mixed evidence regarding hypotheses  $H_1$  and  $H_0$  underscored the need for a comprehensive analysis. Given this, we opted for a mini-meta-analysis to gain a more precise and holistic understanding of our findings. The meta-analysis integrated data from all studies, offering a clearer and more unified perspective on the mimicry-guilt relationship. This approach helped reconcile the varied findings and elucidate the general trends observed in our studies.

### Mini Meta-Analysis

In addition to our primary findings, we conducted a mini-meta-analysis to further examine the effects of mimicry behavior on guilt. However, [Simonsohn et al. \(2022\)](#) and [Vosgerau et al. \(2018\)](#) emphasized that such an approach may be prone to errors such as  $p$ -hacking and misinterpretation due to different studies designs. Therefore, this mini-meta-analysis should be considered a preliminary tool that provides first indications for more in-depth future research. Given potential quality control issues and study variability, we advise caution in interpreting these results and consider our conclusions to be preliminary and not definitive.

Thus, to investigate whether individuals who were somehow mimicked were more likely to experience a higher level of guilt than those who were not mimicked, we extracted the effect size (Cohen's  $d$ ) and the standard error of the effect size from a single comparison of the mimicry and the no mimicry condition. The dependent variable was the level of guilt. To analyze our data, we performed a random-effect meta-analysis, using REML estimation using JASP<sup>7</sup>.

A total of  $k = 6$  own studies were included in the mini-meta-analysis. The observed Cohen's  $d$  effect size estimates ranged from  $Min. = 0.20$  to  $Max. = 0.65$ . The estimated average Cohen's  $d$  based on the random-effects model was Cohen's  $d = 0.43$ , 95% CI [0.23, 0.62]. Therefore, the average outcome differed significantly from zero,  $z = 4.29$ ,  $p < .001$ . According to the  $Q$ -test, the true outcomes appear to be homogeneous,  $Q(5) = 2.13$ ,  $p = .830$ ,  $\tau^2 = 0.00$ ,  $I^2 = 0\%$ . A 95% prediction interval is given by 0.23 to 0.62. Hence, the average outcome is estimated to be positive, with the true outcomes being positive in all the studies too. The rank correlation test did not indicate funnel plot asymmetry ( $p = .126$ ) nor did the regressions test ( $p = .401$ ). This *mini meta-analysis* indicates

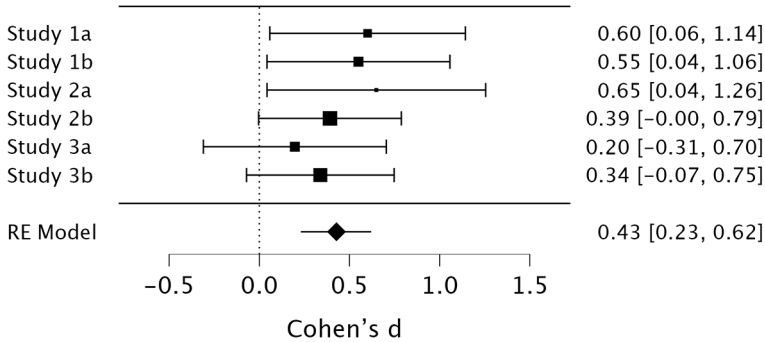
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7) See [Muniak \(2022, <https://osf.io/fsvj5>\)](#).

that mimicked participants were indeed more likely to feel guilt than not mimicked individuals. Please see [Figure 3](#) for a forest plot.

**Figure 3**

*Forest Plot of Meta-Analyzed Samples*



## General Discussion

A series of six studies, supported by a mini-meta-analysis, revealed an unexpected pattern: individuals who were mimicked experienced greater feelings of guilt. This result does not allow us to accept the hypothesis. In fact, we observed results quite the opposite of what we predicted. The analysis of intergroup differences showed that in three out of six studies, we obtained statistically significant differences, indicating that individuals who were mimicked declared significantly more guilt than those who were not. Substantially, the mini meta-analysis confirmed this interpretation. This surprising result carries a few theoretical and practical implications.

## Theoretical Implications

The obtained results provide theoretical implications for both mimicry and guilt. Mimicry is believed to be a social glue mechanism (Dijksterhuis, 2005; Lakin et al., 2003) responsible for initiating and maintaining positive social relationships. However, this study, at first glance, may contribute to a new and promising research trend which undermines this assumption by unpacking the losses stemming from mimicry, such as decreased self-esteem of the mimicked (Kot & Kulesza, 2016) or the mimicker's increased tendency to lie to the mimicker (Muniak et al., 2021).

Nonetheless, when viewed from the perspective of guilt research, the results may support the assumption that mimicry serves as a social bonding mechanism. As indicated in the introduction, guilt is not only aversive (e.g., Haran, 2019; Ranganadhan &

Todorov, 2010; Tanaka et al., 2015; Tennen & Herzberger, 1987) but also has various benefits, serving as a social bonding mechanism (e.g., Basil et al., 2008; Baumeister et al., 1994; Flynn & Schaumberg, 2012; Ketelaar & Au, 2003). Therefore, the mimicked participants may have felt higher levels of guilt due to the interaction of these two social bonding mechanisms. The manipulation of mimicry could intensify guilt in its social dimension to motivate individuals to act towards social bonds, thus improving social relationships and strengthening their ties. If this is the case, the result reinforces the hypothesis that mimicry is a social glue and strengthens the guilt social bonding mechanism.

However, it is crucial that further research continues to examine the multifaceted nature of mimicry and its effects on social interactions. It also highlights the importance of better understanding the role of guilt in social interactions and how other social bonding mechanisms, such as mimicry, may influence it. This is especially important due to the frequent use of mimicry in psychotherapy processes (e.g., Charny, 1966).

## Practical Implications

Tips for therapists emphasize the positive outcomes associated with the use of mimicry in therapeutic processes (e.g., Charny, 1966). However, the results of this study suggest that the situation is more complex than initially thought. On the one hand, utilizing mimicry during psychological care may allow professional personnel to gain a deeper insight into the client's problem (Charny, 1966) and establish stronger rapport (e.g., Lafrance & Broadbent, 1976). On the other hand, this study revealed that mimicry can also intensify feelings of guilt. Therefore, therapists may need to carefully consider the potential benefits and drawbacks of using mimicry in therapy and evaluate alternative approaches to promote positive therapeutic outcomes.

## Limitations and Future Directions

Since the pattern of the results was contrary to the hypothesis, we can only speculate about what mechanism drives this effect. The proposed explanation can be the self-awareness theory (Duval & Wicklund, 1972). It has been shown that self-awareness increases when exposing participants to their reflection in a mirror (e.g., George & Stopa, 2008), the sound of their voice (e.g., Ickes et al., 1973), or both (e.g., Vallacher & Solodky, 1979). Additionally, it has been shown that self-awareness is in fact linked to mimicry (Guéguen, 2011), which suggests that the mimicker is like a mirror for the mimicked, and as a consequence, the mimicked's self-awareness increases. Thus, it is possible that participants, when experiencing increased self-awareness (activated by mimicry), begin to make a deeper self-assessment of their actions. Through this, they may become more aware of the fact that they are the ones who caused the situation, and consequently, they assign more guilt to themselves (e.g., Weiner, 1986). Future research might test this

prediction by measuring self-awareness (e.g., Scheier & Carver, 1985) and testing the mediating role of self-awareness in the linkage between mimicry and guilt.

Another issue is that with this data in hand, we are unable to answer the vital question of whether the presence of mimicry increases guilt, or the absence of mimicry decreases it. Therefore, it is necessary to conduct another experiment with a two-factorial design (2x2). This experiment could answer whether there is an interaction effect between mimicry and guilt. The effect of guilt could be binary (it either appears or it does not, and the guilt is constant in mimicry conditions), or it could be additive (both mimicry and guilt results in the highest guilt).

It should be noted that our study was inspired by the research of Martin et al. (2010), which initially linked mimicry and guilt, and found that participants in the guilt condition were significantly more likely to mimic the person shown in the video than participants in the non-guilt condition. This clearly indicates that participants used mimicry more frequently when feeling guilty, not towards the person involved in the original interaction that triggered the guilt, but towards another person depicted in the video. In some of our studies, we used very different experimental setups from those proposed by Martin et al. (2010). First, in our study, we did not measure the frequency of mimicry of the participants, but the effect of the mimicking participants on their feelings of guilt. Second, the Martin et al. (2010) study measured mimicry toward another person who was not involved in the event triggering the guilt. In our study, we measured the effects of mimicry on the same person who was involved in triggering the feelings of guilt.

Thus, the experimental setups in the Martin et al. (2010) study and our studies were quite different, and there are still several questions that require further research. First, it is important to investigate the frequency of mimicry performed by participants who feel guilty in direct interactions with the person who triggered the feeling of guilt. Furthermore, the question remains as to how mimicry works in a situation in which one person is involved in evoking feelings of guilt in a participant and another, completely different person mimics the participant. Consequently, our research not only deviates in methodology from Martin et al. (2010), but also opens new avenues for understanding the complexity of mimicry in the context of guilt and highlights the need for more nuanced studies.

An further major limitation of this study is certainly the fact that it only measured participants' feelings of guilt at the end of the experimental procedure. This timing could potentially miss capturing emotional responses immediately following the induction of guilt. Future studies should consider including a measure of guilt immediately after its induction to better understand the temporal dynamics of this emotion in relation to mimicry.

Given the complexity of human emotions, future research should undoubtedly measure other emotional states, such as anger, which would provide a deeper insight into the

complexity of the originally observed phenomenon. Moreover, a crucial element in the study of mimicry and guilt seems to be the control of, firstly, whether the mimicry effect occurred and, secondly, if it persisted after the application of the mimicry manipulation. Therefore, in addition to measuring guilt and other emotions that may be involved in this mechanism, future studies should also measure, for example, liking for the experimenter manipulating the mimicry, which is a common method for testing the effectiveness of mimicry (e.g., Muniak et al., 2021).

It should also be acknowledged that our studies, although supported by a sensitivity analysis, were indeed underpowered in some respects. The sensitivity analysis consistently indicated that although our studies were sufficiently powered to detect the observed effect sizes, they were originally designed to detect larger effects. This emphasizes the need for meaningful, confirmatory studies to replicate these findings. The need for replication is particularly important given how anecdotal our findings are, as demonstrated by the Bayes factors.

In our research, we observed that mixed mimicry did not significantly impact guilt, whether it was directly induced or elicited through autobiographical recall. While research on mimicry proves that mixed mimicry can be effective (e.g., Kulesza et al., 2023), we could not detect its impact. A possible explanation could be that in our study, participants were exposed to too much mimicry, thereby nullifying its potential effect. This way of thinking aligns with the recent findings of Wessler et al. (2023), showing that too much mimicry may backfire. Consequently, it is imperative for future studies to explore the complexities of mixed mimicry more thoroughly, particularly in identifying the threshold at which mimicry becomes unproductive.

The last point concerns the control condition used in our studies. The lower feelings of guilt in the group that was not mimicked could be due to the experimenter being perceived as uninterested or uninvolved. If this is the case, this perception could alter the emotional dynamics of the interaction. Future research should investigate alternative control conditions, such as the 'anti-mimicry' condition recently introduced by Rauchbauer et al. (2023). The implementation of such conditions could provide deeper insights into how mimicry influences emotional and social responses, particularly in the context of our findings.

## Conclusion

In conclusion, six studies provided evidence that did not support the hypothesis. Unexpectedly, individuals who were mimicked felt more guilty. The outcome has significant theoretical and practical implications for guilt and mimicry, underscoring the need to enhance comprehension of how guilt operates in social interactions and how social bonding mechanisms, such as mimicry, may increase it.

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**Author Contributions:** *Paweł Muniak*—Idea, conceptualization | Design planning | Data analysis | Data collection | Resource provision (materials, participants, etc.) | Data management (storage, curation, processing, etc.) | Writing | Feedback, revisions | Visualization (data presentation, figures, etc.) | Project coordination, administration | Funding to conduct the work. *Wojciech Kulesza*—Design planning | Feedback, revisions | Supervision, mentoring.

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**Ethics Statement:** Experiments were approved by the local ethics committee (opinion number: 31/2019). Informed consent was obtained from all participants before enrollment in the experimental procedures and data collection. After the procedures were complete, the participants were properly debriefed following the ethics committee suggestions.

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**Data Availability:** For this article, data is freely available (see [Muniak, 2022](#)).

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## Supplementary Materials

For this article, all materials, databases, R codes, and statistical analyses for the experiments are available at the Open Science Framework (see [Muniak, 2022](#)).

### Index of Supplementary Materials

Muniak, P. (2022). *Mimicry and guilt* [Data, code, materials, analyses]. OSF.  
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