Social Neuroscience

ISSN: 1747-0919 (Print) 1747-0927 (Online) Journal homepage: www.tandfonline.com/journals/psns20

Obedience to authority reduces cognitive conflict before an action

Emilie A. Caspar & Guillaume P. Pech

To cite this article: Emilie A. Caspar & Guillaume P. Pech (2024) Obedience to authority reduces cognitive conflict before an action, Social Neuroscience, 19:2, 94-105, DOI: 10.1080/17470919.2024.2376049

To link to this article: https://doi.org/10.1080/17470919.2024.2376049

SOCIAL NEUROSCIENCE
2024, VOL. 19, NO. 2, 94–105
https://doi.org/10.1080/17470919.2024.2376049

Routledge
Taylor & Francis Group

RESEARCH PAPER

Check for updates

Obedience to authority reduces cognitive conflict before an action

Emilie A. Caspar[a] and Guillaume P. Pech[b]

[a]Moral & Social Brain Lab, Department of Experimental Psychology, Ghent University, Ghent, Belgium; [b]Center for Research in Cognition and Neuroscience, Université libre de Bruxelles, Brussels, Belgium

ABSTRACT
How obeying orders impacts moral decision-making remains an open question, despite its significant societal implications. The goal of this study was to determine if cognitive conflict, indexed by mid-frontal theta activity observed before an action, is influenced by the context of obedience. Participants came in pairs and were assigned roles as either agent or victim. Those in the agent role could either decide freely or follow the experimenter's instructions to administer (or refrain from administering) a mildly painful electric shock to the victim in exchange for a small monetary reward. Mid-frontal theta activity was recorded before the agent made their keypress. Results indicated that mid-frontal theta activity was reduced when participants obeyed the experimenter's orders compared to when they acted of their own volition, even though the outcomes of the actions were similar. This finding suggests that obeying orders diminishes cognitive conflict preceding moral decisions that could harm another person. This study sheds light on a potential mechanism explaining how obedience can blurr morality and lessen our natural aversion to harming others.

ARTICLE HISTORY
Received 24 November 2023
Revised 10 June 2024
Published online 08 July 2024

KEYWORDS
Obedience; cognitive conflict; morality; electroencephalography; mid-frontal theta activity; moral conflict

Introduction

The topic of obedience to authority was for a long time approached primarily by social psychologists, particularly since the (in)famous studies of Stanley Milgram. Milgram notably demonstrated that when ordered to inflict severe pain on another innocent person, a large proportion of individuals would comply with those orders. Following these findings, theories were developed to understand how such results were possible. In his 1974 book, Milgram suggested that people can obey orders that cause harm to others, because of a shift from an autonomous state to an agentic state, where individuals perceive themselves as agents executing another person's wishes rather than being personally responsible (Milgram, 1974). However, the validity of this theory raised concerns among several academics (Haslam, Reicher, Millard, & Najbauer, 2015), as no well-controlled and systematic experimental approaches had been conducted to validate it. Years later, drawing on the social identity theory (Tajfel & Turner, 1979), a group of researchers proposed that the behavior of Milgram's participants primarily stemmed from their identification with the experimenter and their mission (Haslam & Reicher, 2017), rather than from them being passive agents. While these researchers found evidence supporting their model in tasks involving passive or virtual behaviors (Haslam et al., 2014; Haslam, Reicher, Millard, & McDonald, 2015), other scholars using real behaviors did not find reliable statistical evidence supporting this theory (Caspar, 2021; Caspar, Gishoma, et al., 2022; Tricoche et al., 2024).

Neuroscience has only recently begun to explore this question, offering fresh, yet complementary, insights into how the act of obeying or issuing commands affects brain function and fosters conditions for moral transgressions (Caspar, 2024a, 2024b). For example, studies where participants were either free to decide or were instructed by an experimenter to deliver (or refrain from delivering) a painful shock in exchange for a small monetary reward revealed that activity in empathy and guilt-related brain regions diminished in coerced decisions compared to free ones (Caspar, Ioumpa, et al., 2020). Additional research indicated that obeying orders diminishes both the implicit feeling of agency and the explicit feeling of responsibility (Caspar et al., 2016; Caspar, Lo Bue, et al., 2020). As these processes have been associated with prosocial or moral decision-making (Caspar, Ioumpa, et al., 2022; Hein et al., 2010; Müller-Pinzler et al., 2017; Stevens & Taber, 2021), this may explain how following orders increases antisocial

CONTACT Emilie A. Caspar Emilie.Caspar@UGent.be Department of Experimental Psychology, Henri Dunantlaan, Ghent University, Ghent 29000, Belgium
Supplemental data for this article can be accessed online at https://doi.org/10.1080/17470919.2024.2376049

conducts. The present study aims to enrich the existing literature by delving into the mechanisms underpinning obedience, with a particular emphasis on cognitive conflict preceding an action decided freely or coercively instructed.

Cognitive conflict refers to the phenomenon where incongruent or competing information challenges the brain's processing mechanisms, necessitating additional cognitive resources to resolve the discrepancy (M. X. Cohen, 2014a). This conflict is commonly observed in tasks that involve decision-making under ambiguous or contradictory circumstances, such as the Stroop task or the Flanker task. Within the context of electroencephalography (EEG), cognitive conflict has been linked to enhanced mid-frontal theta (4–8 Hz) activity (Cavanagh & Frank, 2014; M. Cohen & Cavanagh, 2011; M. X. Cohen & Donner, 2013a). This specific EEG rhythm, predominantly observed over mid-frontal scalp regions, is thought to reflect the engagement and recruitment of cognitive control processes in the anterior cingulate cortex (ACC) and surrounding medial frontal areas (Botvinick et al., 2004). Previous research has demonstrated that decisions that are difficult to make are associated with higher midfrontal theta activity (FMθ, 4–8 Hz) (Cavanagh & Frank, 2014; M. X. Cohen, 2014b; M. Cohen & Cavanagh, 2011; M. X. Cohen et al., 2013; Nigbur et al., 2012) compared to easier decisions.

In the present study, we placed our participants in a difficult moral choice, as they had to decide between inflicting real pain to another person to increase their own monetary gain, or to choose an alternative option that involved not administering pain and not earning extra money. Such decision can create a conflict in the brain, and some previous studies have found that cognitive conflict can be associated with the decision to act in a prosocial way toward others. For instance, some studies have reported higher cognitive conflict when participants had to inhibit prejudice toward an outgroup compared to not inhibiting prejudice (Amodio & Swencionis, 2018; Amodio et al., 2006, 2008; Bartholow et al., 2006; Correll et al., 2006). Another study showed that the higher the mid-frontal theta activity was before obeying the order of sending a shock to another person, the more frequently such orders were disobeyed to avoid hurting that person (Caspar, Gishoma, et al., 2022). However, people were not offered to make fully free decisions in that study, thus not allowing to understand if the situation of obedience influences cognitive conflict compared to free decisions.

In the present study, we aimed to investigate whether obeying orders changes mid-frontal activity preceding a moral decision compared to the same decision made freely. Participants were invited in pairs and undertook a role of agent or a role of victim. Agents could freely decide, or received an instruction from the experimenter, to send or refrain from sending a painful electric shock to the victim in exchange for a small monetary reward. In previous studies, it has been repeatedly observed that participants report feeling less bad and less sorry for inflicting painful shocks in the coerced condition compared to a free-choice condition (Caspar et al., 2016, 2017; Caspar, Ioumpa, et al., 2020). A working hypothesis is that people feel less sorry and less bad for the same behaviors when they follow orders compared to when they act freely, because obeying orders reduces the conflict elicited by the moral decision. We hypothesized that mid-frontal activity would be reduced in the coerced compared to the free-choice condition.

Method

Participants

Sixty-four participants were recruited in 32 same-gender dyads. None of the participants reported to know each other. To calculate the sample size, we conducted power analyses with G*Power (Faul et al., 2007). Since no previous studies targeted mid-frontal theta activity in a similar experimental design, we used a medium effect size of .25, and a power of 85%. It was indicated that to observe a main within-subject effect (Condition, 2 levels), we needed to recruit 38 participants (=18 pairs). However, previous studies showed that people's behaviors are highly variable, with people choosing not to send any shocks, people choosing to send shocks all the time, or people disobeying orders. Therefore, to prevent the risk of data loss, we increased that sample size up to 64. A priori exclusion criteria involved bad EEG signal-to-noise ratio. Based on these criteria, four were removed because of technical problems during the EEG recording (two had no triggers being recorded in the data file; one had a problem with the mastoids; and one had a defect electrode unnoticed by the experimenter during the recording, as located in another room – see experimental procedure below). One participant also did not perform the task until the end due to a delayed start in the testing session. We thus decided not to keep their entire recording and data set, as they were only half complete. For the remaining 59 participants (15 identified as males and 44 identified as females), the mean age was 22.76 years old ($SD = 3.84$). Importantly for EEG data, based on a previous study (Caspar, Ioumpa, et al., 2020), we conducted the statistical analyses only on participants who had at least six trials in each experimental condition (i.e., minimum six shock and no shock trials in both the free-choice and the coerced conditions). We identified 23 participants who had less than 5 trials in one or more experimental condition. Those 23 participants were removed from the EEG analyses, but were kept for the other variables. For the remaining sub-sample of 36 participants used for the EEG analysis, 8 identified as male and 28 identified as female. The mean age was 21.91 years old (SD = 3.21). The study was approved by the local ethics committee of the Faculty of Psychology of the Université libre de Bruxelles (project number: P2022/196). Data and scripts are made available on OSF (https://osf.io/wrs3d/).

Material & procedure

Upon arrival at the laboratory, both participants received instructions about the experiment and jointly provided informed consent, ensuring each was aware of the other's consent. Importantly, no deception was used in the present study, and every step was fully revealed to the participants. Their individual pain thresholds for electrical stimulation were then determined as described in Caspar et al. (2016). Two electrodes were placed on the participants' left hand, specifically on the abductor pollicis muscle, to produce a clear and visible muscle twitch. The threshold was increased in 1 mA increments until a mildly painful stimulation was reached. We approximated an appropriate threshold by asking a series of questions about their pain perception during the calibration (1. "*Is it uncomfortable?*" – 2. "*Is it painful?*" – 3. "*Could you cope with a maximum of 120 of these shocks?*" – 4. "*Could we increase the threshold?*" – 5. "*On a scale from 0 to 10, where 0 is not painful at all and 10 is the worst possible pain you can imagine; how would you rate this stimulus?*"). The questions and answers were made orally, as a discussion between the experimenter and the victim. With this procedure, we ensured that participants were aware of the pain they were going to inflict on the other participant and were willing to experience themselves.

Participants randomly drew a card from a box to determine if they would start as an agent or victim, but they were given the option to switch roles if desired. They were informed that roles would be reversed midway through the experiment, ensuring full reciprocity. When their roles were reversed, we gradually increased the intensity of the electric stimulation back to the threshold that had been indicated by the participants who were initially agents before becoming victims, ensuring their re-habituation. The participant assigned the role of the agent was taken to a small room where the electroencephalogram was located, while the one in the "victim" role was seated in an adjacent room at a table (see Figure 1). Those in the "victim" role placed their hand on a black sheet within the camera's field of view and were instructed not to move it throughout the scanning session. Victims watched a neutral documentary, "Planet Earth," using headphones to ensure they could not hear discussions between the experimenter and the agent.

Before initiating an experimental condition, the experimenter left agents alone in the room, explaining that they were moving to another room to prevent any visual distractions their presence might cause. Each trial began with a fixation cross that lasted for 1 s. Subsequently, in both the free-choice and coerced conditions, agents heard a verbal instruction from the

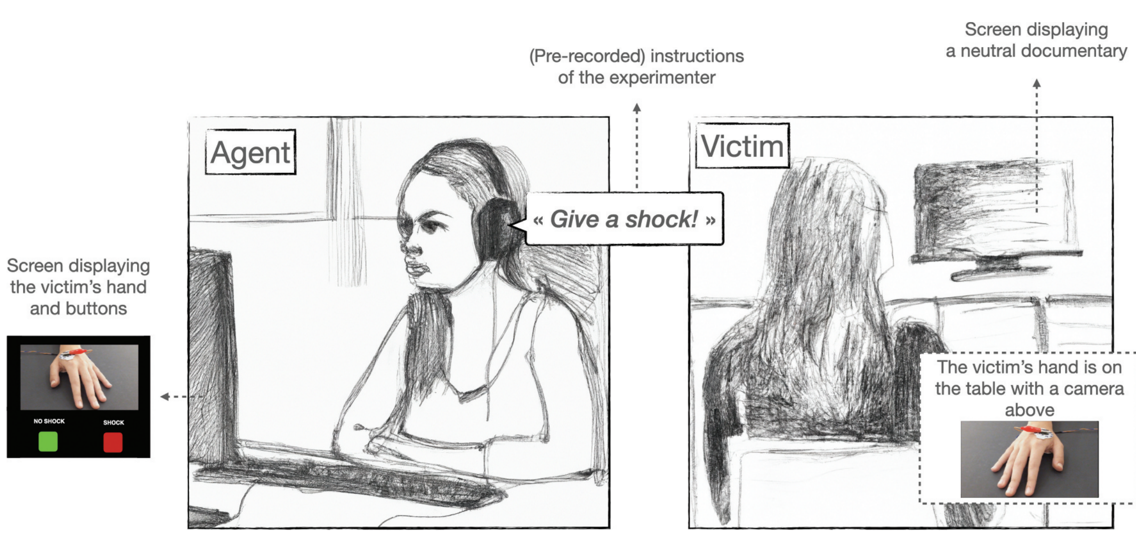

Figure 1. Schematic representation of the experimental set-up. The agent and the victim were located in different rooms. The agent could see on the screen a real-time video display of the victim's hand connected to the machine delivering shocks. The agent had headphones to listen to the experimenter's (pre-recorded) verbal instructions.

experimenter to ensure a consistent sequence of events across conditions. Agents wore headphones, purportedly to hear commands from the experimenter in the adjacent room. In the free-choice condition, the experimenter stated, "you can decide", whereas in the coerced condition, the instructions were either "give a shock" or "don't give a shock". However, in reality, these verbal instructions were prerecorded to maintain a precise timing of the events during the experiment. To enhance the authenticity, each instruction was recorded six times with minor variations in tone and played randomly. The sequence of instructions from the experimenter was entirely random and varied among participants. Following the instruction, a sentence appeared on the agents' screen stating "Please do not press a key". This remained visible for a jittered interval of 4–5 s. Ensuring a sufficient interval between auditory instructions and the keypress was crucial, as auditory stimulations can also induce mid-frontal theta activity (Villena-González et al., 2018). This time gap ensured no overlap between the mid-frontal theta elicited by auditory cues and the mid-frontal theta associated with cognitive conflict preceding an action. When the text disappeared, agents viewed two rectangles on the bottom of their screen: a red one labeled "SHOCK" and a green one labeled "NO SHOCK". The position of these rectangles on the screen's bottom left and right changed randomly with each trial, but the action's outcome always corresponded to the participant's decision (i.e., if they pressed the shock button, a shock was administered in 100% of the cases, and similarly, pressing the no-shock button never resulted in a shock). Agents could then press either button: the "SHOCK" button would administer a shock to the victim and agents would be rewarded by +€0.05, while the "NO SHOCK" button would not. Shocks were delivered to the victim 300 ms post-keypress. Throughout the experiment, agents could see the receiver's hand in real-time via a video feed at the screen's top, with electric shocks causing a visible muscle twitch. Of note, we never incentivized participants to either obey or disobey orders, even though they received orders in the coerced condition. Based on previous studies, participants may be more likely to disobey orders when the experimenter is not physically present in the room. However, we never explicitly mentioned this option to participants to avoid prompting what could be termed "instructed disobedience."

Half of the participants started with the free-choice condition, and the other half started with the coerced condition. The paired participant was not aware of the order of the experimental conditions of the other participant. The task consisted of a total of 120 trials, with 60 in the free-choice condition and 60 in the coerced condition. In coerced blocks, participants were instructed to deliver a shock on 50% of trials, while in the free-choice condition, they were entirely free to decide. To check for a possible effect of Experimenter, two different experimenters tested half of the sample each. This factor was only considered as exploratory, as not considered in our initial power calculations.

At the end of the experimental session, participants were asked to indicate, on scales ranging from −3 (Not at all) to 3 (strongly), how responsible they felt, how sorry they felt and how bad they felt in the two experimental conditions (see **Supplementary S1**). They also had to indicate whether they intentionally disobeyed during the experiment with a "Yes" or "No" response, ensuring that any trials of disobedience were not due to a simple keypress mistake. Participants were paid separately, based on their own gain during the experiment.

EEG recording and analysis

EEG recordings were conducted using Biosemi equipment (see http://www.biosemi.com for hardware details), with data acquired at a sampling rate of 2,048 Hz from 32 channels placed according to the international 10–20 system. Additionally, four additional electrodes were used to capture horizontal eye movement and mastoid signals. Mastoids were used as a reference. According to the hardware of the Biosemi system, the impedance of each electrode was between −20 µV and 20 µV. The Biosemi amplifier automatically applies a band-pass filter between 0 and 256 Hz, but we re-applied the default Finite Impulse Response (FIR) in MNE between 1 Hz and 30 Hz for our EEG analyses. Following the established literature (M. Cohen & Cavanagh, 2011; M. X. Cohen & Donner, 2013b), we computed the frontal midline theta frequency (FMθ) by averaging Fz, Cz, FC1, and FC2 electrodes. Time-frequency power was extracted for each trial using the tfr_morlet function from MNE-Python. The parameters used were the frequency range of 2 Hz to 30 Hz with 80 logarithmically spaced bins, logarithmically spaced cycles from 4 to 14, and Fast Fourier Transform. The epochs analyzed were from −2 s to 2 s around the keypress (response-locked). All power values in the Time-Frequency Representation (TFR) were normalized to the average baseline power in each frequency band using a decibel (dB) transform [dB power = 10 × log10(power/baseline)], employing the "logratio" parameter of MNE-Python. The baseline power was computed as the average power across all experimental conditions from 1.9 s to 2.1 s after the keypress to ensure no overlap with other cognitive processes evoked during the experimental tasks. To determine the time and frequency windows of interest, shorter epochs from −500 ms to 1 s were analyzed, selecting the value significantly different from the others. To find values significantly different, we selected values above the mean + 1.96*standard deviation of all values. The formula provides a range of values within which we can reasonably expect the true population mean to fall with a certain level of confidence (i.e., 95% confidence (Field, Field, & Miles, 2012)). This value was used to create a circular mask for extracting FMθ power within the specific time and frequency windows (see Figure 2 for visualization). Finally, for each participant, the mean value within this mask defined the time/frequency window.

Results

Data were analyzed with both frequentist and Bayesian statistics (Dienes, 2011). Bayesian statistics assess the likelihood of the data under both the null and the alternative hypothesis. In most cases, we report BF_{10}, which corresponds to the $p(\text{data}|H_1)/p(\text{data}|H_0)$. Generally, a BF between 1/3 and 3 indicates that the data is similarly likely under the H_1 and H_0, and that the data thus do not adjudicate which is more likely. A BF_{10} below 1/3 or above 3 is interpreted as supporting H_0 and H_1, respectively. For instance, $BF_{10} = 20$ would mean that the data are 20 times more likely under H_1 than H_0 providing very strong support for H_1, while $BF_{10} = .05$ would mean that the data are 20 times more likely under H_0 than H_1 providing very strong support for H_0 (Marsman & Wagenmakers, 2017). BF and *p* values were calculated using JASP (Love et al., 2019) and the default priors implemented in JASP (Keysers et al., 2020). Default priors used in JASP depend on the statistical tests performed (for ANOVA, see (Rouder et al., 2012); for t-tests, see (Ly et al., 2016); for correlations, see (Wagenmakers et al., 2016)). Outliers were removed using a combination of outlier detection methods. Outliers were defined as values detected as outliers by at least two of the following methods: 2.5 times the Median Absolute Deviation (MAD), 1.5 times the Interquartile Range (IQR), and 2.5 times the Standard Deviation (SD). This approach allowed us to benefit from the strengths of each method while reducing biases in the procedure of outlier removal.

Number of shocks sent

In the free-choice condition, agents could entirely decide between sending or not sending a shock to the victim, while in the coerced condition, they were ordered to send a shock on 30/60 trials. Agents could nonetheless disobey, as the experimenter was located in another room and did not react if they pressed another key. When considering the full sample, irrespective of the participants excluded because they had less than five trials in one of the experimental

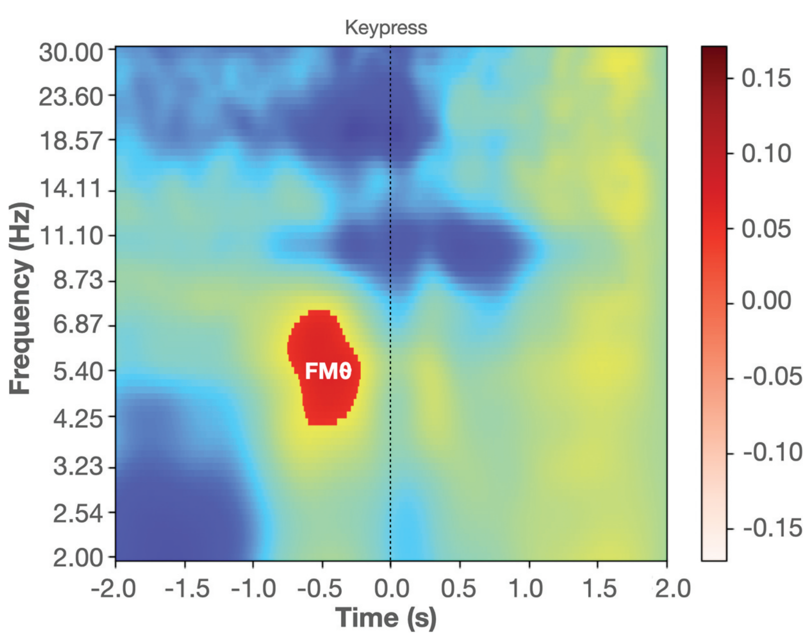

Figure 2. Response-locked time frequency power plots for the four electrodes (Fz, Cz, FC1, FC2). The significance level taken was $p > .05$.

conditions, 35/59 participants fully obeyed, 11/59 disobeyed in a prosocial way (i.e., pressing the NO SHOCK button while ordered not to send a shock to the victim), 8/59 disobeyed in an antisocial way (i.e., pressing the SHOCK button while ordered to send a shock to the victim), and 5/59 disobeyed by contradiction (i.e., sometimes refusing to send a shock, sometimes refusing not to send a shock). A repeated-measure ANOVA with Condition (free-choice, coerced) as a within-subject factor showed anecdotal evidence in favor of H0 for no difference between the two conditions ($p > .2$, $BF_{incl} = .380$). In an exploratory analysis, the same ANOVA was conducted with Experimenter as a between-subject factor. All main effects or interactions were in favor of H0 (all *ps* > .1, all $BFs_{incl} < .278$).

How responsible, sorry and bad

We conducted paired comparisons between the free-choice and the coerced conditions on how responsible, how sorry and how bad participants felt during the task. Results indicated that participants reported feeling more responsible in the free-choice (2.19, SD = 1.39) compared to the coerced condition (–.138, SD = 1.772, $t_{(57)} = 10.302$, $p < .001$, Cohen's d = 1.353, $BF_{10} = 5.691 \times 10^{e+11}$). They also reported feeling sorrier and more bad for sending the shocks to the victim in the free choice condition (bad: .379, SD = 1.84; sorry: 1.103, SD = 1.88) compared to the coerced condition (bad: –.310, SD = 2.03, $t_{(57)} = 2.936$, $p = .005$, Cohen's d = .386, $BF_{10} = 6.742$; and sorry: .448, SD = 2.11, $t_{(57)} = 2.784$, $p = .007$, Cohen's d = .366, $BF_{10} = 4.678$).

Mid-frontal theta activity (FMθ)

A repeated-measures ANOVA was conducted with Condition (free-choice; coerced) and Shock (shock; no shock) as within-subject factors on the mid-frontal theta activity (FMθ). We excluded trials where agents disobeyed orders because, according to the existing literature (Caspar, Gishoma, et al., 2022; Tricoche et al., 2024), disobeying an order may involve different brain processes. Our focus was indeed on the clear distinction between obeying and deciding freely. We observed evidence in favor of H1 for a main effect of Condition ($F_{(1,27)} = 8.038$, $p = .009$, $\eta^2_p = .229$, $BF_{incl} = 4.124$), with a lower FMθ in the coerced condition (0.070, $CI_{95\%} = 0.025–0.115$) compared to the free-choice condition (0.127, $CI_{95\%} = 0.082–0.171$), see Figure 3(a). The main effects of Shock ($p > .4$, $BF_{incl} = .540$) and the interaction ($p > .056$, $BF_{incl} = 1.635$) were inconclusive.

We conducted an exploratory analysis by adding Experimenter (Experimenter 1; Experimenter 2) as a between-subject factor. The general pattern of results remained unchanged, with an anecdotal evidence in favor of H1 for a main effect of Condition ($F_{(1,25)} = 6.630$, $p = .016$, $\eta^2_p = .210$, $BF_{incl} = 2.730$), and while other main effects or interactions were inconclusive or in favor of H0 (all *ps* > .073; all $BFs_{incl} < 1.067$ & > .124). We conducted another exploratory analysis with Order of Condition (free-choice first, coerced first) as a between-subject factor. The main effect of Condition was still in favor of H1 ($F_{(1,26)} = 10.824$, $p = .003$, $\eta^2_p = .294$, $BF_{incl} =$

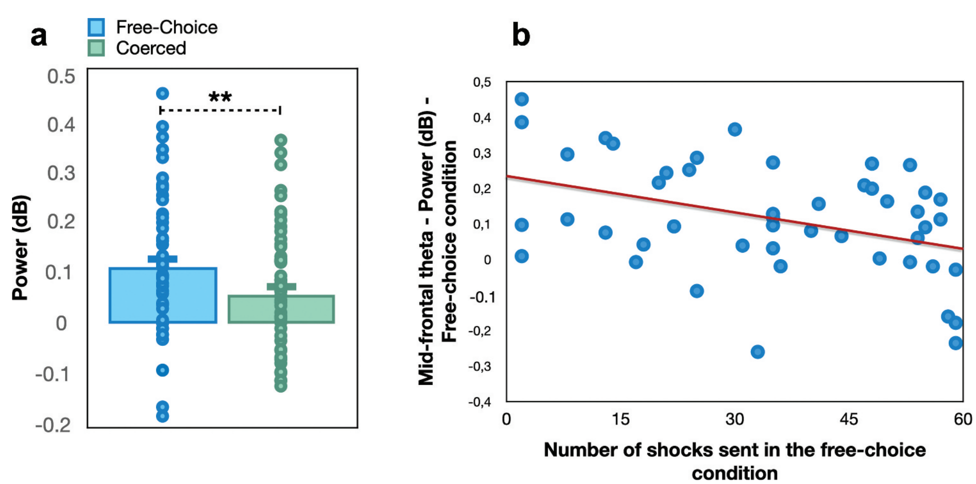

Figure 3. a) Graphical representation of the mid-frontal theta activity across the free-choice (blue) and the coerced (green) conditions. All tests were two tailed. **represents a *p* value between .001 and .01 and a BF > 3. Error bars represent standard errors. b) Graphical representation of the correlation between the number of shocks sent in the free-choice condition and the mid-frontal theta activity in that condition.

3.801), while its interaction with the factor Order of Condition was inconclusive ($p > .1$, BF_{incl}= .719). We observed an additional interaction Shock*Order of Condition that was significant with the frequentist approach, but inconclusive with the Bayesian approach ($F_{(1,26)} = 4.255$, p = .049, η^2_p = .141, BF_{incl}= .832). This interaction was not investigated further as not part of our hypothesis and not conclusive. Other main effects or interactions were inconclusive (all ps > .057; all BFs_{incl} <1.662 & > .396).

We further checked whether the observed results could be linked to individual strategies between participants. We thus ran an additional exploratory analysis with the same within-subject factors and Obedience (fully obeyed; disobeyed on some trials) as a between-subject factor in order to check if the observed pattern of results could differ between participants who always obeyed orders and those who sometimes disobeyed orders. These analyses were conducted solely on EEG results from which only the obedience trials had been excluded. We again observed evidence in favor of H1 for a main effect of Condition ($F_{(1,26)} = 4.231$, p= .050, η^2_p= .140, $BF_{incl} = 3.288$). All the other main effects or interactions were in favor of H0 or inconclusive (all ps > .077; all BFs_{incl} <1.135 & > .291).

Finally, we conducted another exploratory analysis to determine to what extent habituation to the task would influence the results. We re-analyzed the FMθ, splitting the grand averages between the first half and the second half of the trials, thereby creating a new within-subject factor. The main effect of Condition remained significant ($F_{(1,26)} = 7.910$, p= .009, η^2_p= .233) with a similar pattern of results as before, but inconclusive with the Bayesian approach (BF_{incl}= .982). The main effect of Half (1st, 2nd) was in favor of H0 ($p > .3$, BF_{incl} =.156). All the other main effect or interactions were in favor of H0 (all ps>.3, all BFs_{incl} <.125).

Correlations

We also ran exploratory Pearson correlations between the different questionnaires. To correct for multiple comparisons with the frequentist statistics, we applied a False Discovery Rate (FDR) approach with the Benjamini and Hochberg method (Benjamini & Hochberg, 1995) to each p-value. To preserve variability in behaviors, all participants were included, not only those with more than five trials in each condition.

Correlations in the free-choice condition

We first conducted correlations in order to determine if the number of shocks participants decided to deliver in the free-choice condition would be associated with the FMθ, with how responsible they felt, with how sorry they felt, and with how bad they felt. Overall, we observed evidence in favor of H1 for a negative correlation between the number of shocks sent and the overall FMθ in the free-choice condition ($r = -.397$, $p_{FDR} = .024$, $BF_{10} = 7.415$, see Figure 3(b)). The correlation with their feeling of responsibility was significant with the frequentist approach and anecdotally in favor of H1 with the Bayesian approach ($r = -.306$, p_{FDR} = .040, $BF_{10} = 2.333$). These results suggest that those sending less shocks to the victim were those reporting feeling more responsible and having a higher mid-frontal theta activity, as an index of more cognitive conflict. The correlations with how sorry and how bad they felt were inconclusive with the Bayesian approach (all ps_{FDR}>.046, $BF_{10} = 1.443$ & = 1.062).

Correlations in the coerced condition

We then conducted the same analysis in the coerced condition. We observed a negative correlation between the number of shocks sent and how sorry (r=−.326, p_{FDR}= .026, $BF_{10} = 3.409$) and how bad they felt (r=−.381, p_{FDR}= .012, $BF_{10} = 11.321$). Other correlations were in favor of H0, including the correlation with the FMθ in the coerced condition (all ps_{FDR}>.5, all $BFs_{10} \leq .230$). When correlating specifically no shock trials in the coerced condition, this correlation was significant with the frequentist approach and anecdotally in favor of H1 with the Bayesian approach (r= −.326, p_{FDR}= .036, BF_{10} = 2.606). The same correlation for shock trials was inconclusive (p_{FDR} >.1, $BF_{10} = .450$).

Discussion

In the present study, we aimed to investigate whether obeying orders would reduce mid-frontal theta activity, an index of cognitive conflict, before making an action. Our results supported this hypothesis, as we observed that mid-frontal theta activity before a keypress was reduced in the coerced condition compared to the free-choice condition. Interestingly, this was the case for both shock and no shock trials as we failed to observe a significant interaction between condition and shocks. This result may suggest a global effect of obedience to authority, where obeying orders reduces any conflict that making a moral action might engender. The absence of a difference between shock and no shock trials has also been observed in studies targeting the sense of agency (Caspar et al., 2016, 2017), which was reduced in the coerced condition compared to the free-choice condition, irrespective of the outcome. However, this effect might also be inherent to our experimental paradigm. Indeed, our experimental approach involves creating a moral dilemma for participants; they must choose to benefit themselves via a monetary gain at the detriment of another participant, who receives a painful shock. From previous studies, we know that even a minimal monetary reward can be significant for some participants (Caspar, 2021; Caspar, Gishoma, et al., 2022). In a prior study (Caspar, Gishoma, et al., 2022), it was observed that scoring high on a scale measuring the importance given to money was associated with lower FMθ before administering a shock to someone. Therefore, in the free-choice condition, when participants choose not to inflict pain on another person, they may also experience conflict since this action causes them not to gain a monetary reward. Additional studies are needed to further explore these findings by studying obedience to other types of orders. This would help determine whether this is a universal effect of obedience or an effect dependent on the conflict elicited by the decision.

A few previous studies have investigated how performing free-choice or forced-choice tasks influence mid-frontal theta activities (Giersiepen et al., 2023; Zheng et al., 2020). However, these studies primarily focused on stimulus-locked mid-frontal theta, examining the conflict elicited by the outcomes of actions, rather than the conflict at the decision phase. In this study, we focused on response-locked mid-frontal theta to capture the conflict before making a decision. Our results thus extend previous findings, indicating that conflict is also reduced during the decisional phase. One mechanism associated with reduced mid-frontal theta in forced-choice versus free-choice is that free-choice may be more cognitively demanding. In free-choice tasks, participants must actively make a decision, whereas, in forced-choice trials, they can simply passively follow instructions. Making decisions requires mental effort or cognitive control (Pignatiello et al., 2020). Based on this interpretation, it suggests that merely following an experimenter's orders reduces the cognitive load associated with making a decision. This interpretation aligns with explicit reports from participants who indicated that it is "easier" to just follow orders (Caspar, 2024b). The extent to which this effect is specific to moral decisions compared to neutral contexts remains to be determined.

Interestingly, we also did not observe any effect of the type of experimenter on the mid-frontal theta activity. This result is actually consistent with previous studies, where the identity or rank of the person giving orders did not influence the neuro-cognitive processes investigated under obedience (Caspar et al., 2018; Caspar, Lo Bue, et al., 2020). For instance, there was no difference on the feeling of agency in both civilians and military cadets in a free-choice and a coerced condition, regardless of whether they received commands from a civilian experimenter, or from a higher-ranked military officer (Caspar, Lo Bue, et al., 2020). Taken together, these results suggest that when people accept to obey orders, the neural attenuation observed is global. However, the analyses conducted to evaluate the effect of an experimenter were exploratory and not planned in our power analysis, similar to the other exploratory analyses we conducted, such as those to evaluate the effect of the order of experimental conditions. Caution must thus be taken in the interpretation to avoid making strong conclusions from potentially underpowered statistical analyses, and additional studies are required.

We observed a correlation between the number of shocks sent in the free-choice condition and the mid-frontal theta activity in that same condition. This result would suggest that those who experienced the moral decision as more conflicting were less likely to choose to hurt the victim. An alternative explanation could nonetheless be made and would relate to the frequency of the actions being performed. Having to perform a less frequent action is known to necessitate cognitive control (Liebrand et al., 2018). Accordingly, several studies have observed higher/lower theta activity for frequent compared to infrequent actions (Kaiser & Schütz-Bosbach, 2021; Kaiser et al., 2022). Moreover, when participants learn to enact a cognitively challenging motor response via repeated trials, their associated theta activity decreases over time (Clarke et al., 2018). In the present study, participants may find eliciting electrical shocks difficult at the beginning of the task, but habituate or learn to engage in this behavior over the course of the task. As a result, the mid-frontal theta activity could decrease when more shocks are sent – thus resulting in a similar correlation. We thus ran an additional analysis conducted on the first half and the second half of the task to test this effect of habituation. We observed evidence in favor of H0 with both the frequentist and the Bayesian approach, ruling out this alternative hypothesis. In addition, while previous studies suggested a relatively global effect of action frequency on mid-frontal theta (Clarke et al., 2018), the present study appears to be rather specific to the free-choice condition, as the correlation was in favor of H0 in the coerced condition, despite a similar number of shocks sent in the two experimental conditions. Such results thus indeed suggest that those who experienced the moral decision as more conflicting were less likely to choose to hurt the victim when they can freely choose what action to execute, but not when they obey orders. A possible interpretation is that obeying orders already leads to a sort of floor effect regarding the conflict it creates.

In the present study, we use the term "cognitive conflict" as it is commonly referenced in the literature associated with mid-frontal theta activity prior to a decision (Cavanagh & Frank, 2014). However, unlike the existing literature where most outcomes of actions are non-moral, the participants' decisions in our paradigm were clearly moral (i.e., harming someone in exchange for money). Since we observed a correlation between the number of shocks delivered and mid-frontal theta activity, our paradigm may have elicited a moral conflict rather than a cognitive conflict. However, the lack of literature on EEG correlates of moral conflicts prior to an action prevents us from drawing firm conclusions. It would therefore be valuable for future research to investigate whether moral and non-moral decisions similarly influence mid-frontal theta activity.

It would also be interesting to evaluate if the same relationships between mid-frontal theta activity and prosocial behaviors remain similar depending on the identity of the victim. The literature on prejudice has largely showed that when we face an individual considered as an outgroup, our prosociality can be reduced (Amodio & Cikara, 2021), as some critical neuro-cognitive processes for decision-making, notably empathy for pain (Hein et al., 2010; Pech & Caspar, 2022). Previous studies have found a relationship between mid-frontal theta activity and prosociality in the literature of intergroup biases (Amodio & Swencionis, 2018; Amodio et al., 2006, 2008; Bartholow et al., 2006; Correll et al., 2006), but a dissociation has also been observed (Pech et al., 2023). For instance, it was observed that former genocide perpetrators in Rwanda displayed a greater intended prosociality toward victims compared to their own ingroup (Pech et al., 2023). However, mid-frontal theta activity was higher before taking the decision to act in a prosocial way toward a victim than toward their own ingroup, suggesting a higher conflict. A promising line of research would be to deepen our understanding of the relationship between mid-frontal theta activity and social behaviors.

In the coerced condition, we did not observe a correlation between the mid-frontal theta activity before accepting to obey an order involving sending a shock to the victim and the number of shocks sent. In a previous study conducted on Rwandese born after the Genocide Against Tutsis (Caspar, Gishoma, et al., 2022), we had observed that a higher mid-frontal theta activity when obeying the order to send a painful shock to a victim was associated with a greater prosocial disobedience (i.e., sending less shocks than requested by the experimenter). However, here, we failed to observe such correlation. A major difference is the variability in disobedience decisions. The present study indeed induced less disobedience than in the previous study (Caspar, Gishoma, et al., 2022), an effect that might be related to experimental differences. In the present study, we never explicitly mentioned that they could disobey, while in this option was offered in (Caspar, Gishoma, et al., 2022), leading to more disobedience. Even though a fair number of participants disobeyed in the present study, the lack of variability compared to previous study may account for the failure to replicate these results. Another possibility is the different populations targeted and their respective history. In that previous study (Caspar, Gishoma, et al., 2022), we tested Rwandese born after the genocide. Due to the history of their country, there is a huge concern regarding blind obedience to authority in the population (Paluck & Green, 2009; Prunier, 1998). For them, obeying orders that cause harm to another person may induce more conflict than in other populations. In the present study, we recruited participants from Brussels (Belgium) and even though we did not ask them about their demographics and family history, based on demographic statistics of the city (Deboosere et al., 2009), we expect that a majority of our participants were Europeans.

To conclude, the present study suggests that obeying orders reduces cognitive conflict between choosing between (im)moral actions. The notion of morality can also greatly vary between individuals (Gert & Gert, 2020), and the degree of mid-frontal theta activity observed before actions might depend on the perception of morality. During genocides or wars for instance, morality can be neutralized by different processes that involve the classification and dehumanization of another group of individuals (Anderson, 2017). Combined with the fact that obeying orders reduces conflict before making a moral decision, such line of research could help reveal one of the many mechanisms explaining how mass-violence is possible (Caspar, 2024).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The study was funded by a grant Fond d'Encouragement à la Recherche (Université libre de Bruxelles), granted to Emilie Caspar. The authors are grateful to Mouna Begdouri Harfouch, Heriberto Antonio Matos Rosal, and Loïs Martin who help in data collection.

Authors contribution

E.A.C. developed the study concept. E.A.C. and G.P. created the method and scripted the task. E.A.C. and G.P. trained the interns for data collection and supervised them. E.A.C. and G. P. analyzed the data. E.A.C. wrote the first draft of the manuscript and G.P. provided comments. All authors agree with the final version.

References

Amodio, D. M., & Cikara, M. (2021). The social neuroscience of prejudice. *Annual Review of Psychology*, *72*(1), 439–469. https://doi.org/10.1146/annurev-psych-010419-050928

Amodio, D. M., Devine, P. G., & Harmon-Jones, E. (2008). Individual differences in the regulation of intergroup bias: The role of conflict monitoring and neural signals for control. *Journal of Personality and Social Psychology*, *94*(1), 60–74. https://doi.org/10.1037/0022-3514.94.1.60

Amodio, D. M., Kubota, J. T., Harmon-Jones, E., & Devine, P. G. (2006). Alternative mechanisms for regulating racial responses according to internal vs external cues. *Social Cognitive and Affective Neuroscience*, *1*(1), 26–36. https://doi.org/10.1093/scan/nsl002

Amodio, D. M., & Swencionis, J. K. (2018). Proactive control of implicit bias: A theoretical model and implications for behavior change. *Journal of Personality and Social Psychology*, *115* (2), 255–275. https://doi.org/10.1037/pspi0000128

Anderson, K. (2017). 'Who was I to stop the killing?' moral neutralization among Rwandan genocide perpetrators. *Journal of Perpetrator Research*, *1*(1), Article 1. https://doi.org/10.21039/jpr.v1i1.49

Bartholow, B. D., Dickter, C. L., & Sestir, M. A. (2006). Stereotype activation and control of race bias: Cognitive control of inhibition and its impairment by alcohol. *Journal of Personality and Social Psychology*, *90*(2), 272–287. https://doi.org/10.1037/0022-3514.90.2.272

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, *57*(1), 289–300. https://doi.org/10.1111/j.2517-6161.1995.tb02031.x

Botvinick, M. M., Cohen, J. D., & Carter, C. S. (2004). Conflict monitoring and anterior cingulate cortex: An update. *Trends in Cognitive Sciences*, *8*(12), 539–546. https://doi.org/10.1016/j.tics.2004.10.003

Caspar, E. A. (2021). A novel experimental approach to study disobedience to authority. *Scientific Reports*, *11*(1), 22927. https://doi.org/10.1038/s41598-021-02334-8

Caspar, E. A. (2024). Understanding motivations and desistance: Interviews with genocide perpetrators from Rwanda and Cambodia. *Journal of Perpetrator Research*, 6(2). https://doi.org/10.21039/jpr.6.2.142

Caspar, E. A. (2024a). How can people commit atrocities when they follow orders? From qualitative interviews with former genocide perpetrators to neuroscience research. *Philosophia Scientiae*, *28*(2), 193–219. https://doi.org/10.4000/11ptz

Caspar, E. A. (2024b). *Just following orders? Atrocities and the brain science of obedience*. Cambridge University Press.

Caspar, E. A., Christensen, J. F., Cleeremans, A., & Haggard, P. (2016). Coercion changes the sense of agency in the human brain. *Current Biology*, *26*(5), 585–592. https://doi.org/10.1016/j.cub.2015.12.067

Caspar, E. A., Cleeremans, A., Haggard, P., & Costantini, M. (2018). Only giving orders? An experimental study of the sense of agency when giving or receiving commands. *PLOS ONE*, *13*(9), e0204027. https://doi.org/10.1371/journal.pone.0204027

Caspar, E. A., Gishoma, D., & Magalhaes de Saldanha da Gama, P. A. (2022). On the cognitive mechanisms supporting prosocial disobedience in a post-genocidal context. *Scientific Reports*, *12*(1), Article 1. https://doi.org/10.1038/s41598-022-26460-z

Caspar, E. A., Ioumpa, K., Arnaldo, I., Angelis, L. D., Gazzola, V., & Keysers, C. (2022). Commanding or being a simple intermediary: How does it affect moral behavior and related brain mechanisms? *ENeuro*, *9*(5), 0508–21. https://doi.org/10.1523/ENEURO.0508-21.2022

Caspar, E. A., Ioumpa, K., Keysers, C., & Gazzola, V. (2020). Obeying orders reduces vicarious brain activation towards victims' pain. *Neuroimage: Reports*, *222*, 117251. https://doi.org/10.1016/j.neuroimage.2020.117251

Caspar, E. A., Lo Bue, S., Magalhães De Saldanha da Gama, P. A., Haggard, P., & Cleeremans, A. (2020). The effect of military training on the sense of agency and outcome processing. *Nature Communications*, *11*(1), Article 1. https://doi.org/10.1038/s41467-020-18152-x

Caspar, E. A., Vuillaume, L., Magalhães De Saldanha da Gama, P. A., & Cleeremans, A. (2017). The influence of (Dis) belief in free will on immoral behavior. *Frontiers in Psychology*, *8*, 8. https://doi.org/10.3389/fpsyg.2017.00020

Cavanagh, J. F., & Frank, M. J. (2014). Frontal theta as a mechanism for cognitive control. *Trends in Cognitive Sciences*, *18*(8), 414–421. https://doi.org/10.1016/j.tics.2014.04.012

Clarke, A., Roberts, B. M., & Ranganath, C. (2018). Neural oscillations during conditional associative learning. *Neuroimage: Reports*, *174*, 485–493. https://doi.org/10.1016/j.neuroimage.2018.03.053

Cohen, M., & Cavanagh, J. F. (2011). Single-trial regression elucidates the role of prefrontal theta oscillations in response conflict. *Frontiers in Psychology*, *2*, 30. https://doi.org/10.3389/fpsyg.2011.00030

Cohen, M. X. (2014a). A neural microcircuit for cognitive conflict detection and signaling. *Trends in Neurosciences*, *37*(9), 480–490. https://doi.org/10.1016/j.tins.2014.06.004

Cohen, M. X. (2014b). A neural microcircuit for cognitive conflict detection and signaling. *Trends in Neurosciences*, *37*(9), 480–490. https://doi.org/10.1016/j.tins.2014.06.004

Cohen, M. X., & Donner, T. H. (2013a). Midfrontal conflict-related theta-band power reflects neural oscillations that predict behavior. *Journal of Neurophysiology*, *110*(12), 2752–2763. https://doi.org/10.1152/jn.00479.2013

Cohen, M. X., & Donner, T. H. (2013b). Midfrontal conflict-related theta-band power reflects neural oscillations that predict behavior. *Journal of Neurophysiology*, *110*(12), 2752–2763. https://doi.org/10.1152/jn.00479.2013

Cohen, M. X., Ridderinkhof, K. R., & Maurits, N. M. (2013). EEG source reconstruction reveals frontal-parietal dynamics of spatial conflict processing. *PLOS ONE*, *8*(2), e57293. https://doi.org/10.1371/journal.pone.0057293

Correll, J., Urland, G. R., & Ito, T. A. (2006). Event-related potentials and the decision to shoot: The role of threat perception and cognitive control. *Journal of Experimental Social Psychology*, *42*(1), 120–128. https://doi.org/10.1016/j.jesp.2005.02.006

Deboosere, P., Eggerickx, T., Van Hecke, E., & Wayens, B. (2009). The population of Brussels: A demographic overview (M. Bramley, Trans.). *Brussels Studies La Revue Scientifique Pour Les Recherches Sur Bruxelles/Het Wetenschappelijk Tijdschrift Voor Onderzoek over Brussel/The Journal of Research on Brussels*. https://doi.org/10.4000/brussels.891

Dienes, Z. (2011). Bayesian versus orthodox statistics: Which side are you on? *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *6*(3), 274–290. https://doi.org/10.1177/1745691611406920

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavior, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Field, A., Field, Z., & Miles, J. (2012). *Discovering Statistics Using R* (pp. 1–992). SAGE Publications Ltd.

Gert, B., & Gert, J. (2020Fall) The definition of morality. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. *Metaphysics Research Lab. Stanford University*. https://plato.stanford.edu/archives/fall2020/entries/morality-definition/

Giersiepen, M., Schütz-Bosbach, S., & Kaiser, J. (2023). Freedom of choice boosts midfrontal theta power during affective feedback processing of goal-directed actions. *Biological Psychology*, *183*, 108659. https://doi.org/10.1016/j.biopsycho.2023.108659

Haslam, S. A., & Reicher, S. D. (2017). 50 years of "obedience to authority": From blind conformity to engaged followership. *Annual Review of Law and Social Science*, *13*(1), 59–78. https://doi.org/10.1146/annurev-lawsocsci-110316-113710

Haslam, S. A., Reicher, S. D., & Birney, M. E. (2014). Nothing by mere authority: Evidence that in an experimental analogue of the Milgram paradigm participants are motivated not by orders but by appeals to science. *Journal of Social Issues*, *70* (3), 473–488. https://doi.org/10.1111/josi.12072

Haslam, S. A., Reicher, S. D., Millard, K., & McDonald, R. (2015). 'Happy to have been of service': The Yale archive as a window into the engaged followership of participants in Milgram's 'obedience' experiments. *British Journal of Social Psychology*, *54*(1), 55–83. https://doi.org/10.1111/bjso.12074

Haslam, S. A., Reicher, S. D., Millard, K., & Najbauer, J. (2015). Shock treatment: Using immersive digital realism to restage and Re-examine Milgram's 'obedience to authority' research. *PLOS ONE*, *10*(3), e109015. https://doi.org/10.1371/journal.pone.0109015

Hein, G., Silani, G., Preuschoff, K., Batson, C. D., & Singer, T. (2010). Neural responses to ingroup and outgroup members' suffering predict individual differences in costly helping. *Neuron*, *68*(1), 149–160. https://doi.org/10.1016/j.neuron.2010.09.003

Kaiser, J., Iliopoulos, P., Steinmassl, K., & Schütz-Bosbach, S. (2022). Preparing for success: Neural frontal theta and posterior alpha dynamics during action preparation predict flexible resolution of cognitive conflicts. *Journal of Cognitive Neuroscience*, *34*(6), 1070–1089. https://doi.org/10.1162/jocn_a_01846

Kaiser, J., & Schütz-Bosbach, S. (2021). Motor interference, but not sensory interference, increases midfrontal theta activity and brain synchronization during reactive control. *The Journal of Neuroscience*, *41*(8), 1788–1801. https://doi.org/10.1523/JNEUROSCI.1682-20.2020

Keysers, C., Gazzola, V., & Wagenmakers, E.-J. (2020). Using Bayes factor hypothesis testing in neuroscience to establish evidence of absence. *Nature Neuroscience*, *23*(7), Article 7. 788–799. https://doi.org/10.1038/s41593-020-0660-4

Liebrand, M., Kristek, J., Tzvi, E., Krämer, U. M., & DiRusso, F. (2018). Ready for change: Oscillatory mechanisms of proactive motor control. *PLoS One*, *13*(5), e0196855. https://doi.org/10.1371/journal.pone.0196855

Love, J., Selker, R., Marsman, M., Jamil, T., Dropmann, D., Verhagen, J., Ly, A., Gronau, Q. F., Šmíra, M., Epskamp, S., Matzke, D., Wild, A., Knight, P., Rouder, J. N., Morey, R. D., & Wagenmakers, E.-J. (2019). JASP: Graphical statistical software for common statistical designs. *Journal of Statistical Software*, *88*(2), 1–17. https://doi.org/10.18637/jss.v088.i02

Ly, A., Verhagen, J., & Wagenmakers, E.-J. (2016). Harold Jeffreys's default Bayes factor hypothesis tests: Explanation, extension, and application in psychology. *Journal of Mathematical Psychology*, *72*, 19–32. https://doi.org/10.1016/j.jmp.2015.06.004

Marsman, M., & Wagenmakers, E.-J. (2017). Bayesian benefits with JASP. *European Journal of Developmental Psychology*, *14*(5), 545–555. https://doi.org/10.1080/17405629.2016.1259614

Milgram, S. (1974). *Obedience to authority: An experiment view*. Harper & Row.

Müller-Pinzler, L., Krach, S., Krämer, U. M., & Paulus, F. M. (2017). The social neuroscience of interpersonal emotions. In M. Wöhr & S. Krach (Eds.), *Social behavior from rodents to humans: Neural foundations and clinical implications* (pp. 241–256). Springer International Publishing. https://doi.org/10.1007/7854_2016_437

Nigbur, R., Cohen, M. X., Ridderinkhof, K. R., & Stürmer, B. (2012). Theta dynamics reveal domain-specific control over stimulus and response conflict. *Journal of Cognitive Neuroscience*, *24*(5), 1264–1274. https://doi.org/10.1162/jocn_a_00128

Paluck, E. L., & Green, D. P. (2009). Deference, dissent, and dispute resolution: An experimental intervention using mass media to change norms and behavior in Rwanda. *American Political Science Review*, *103*(4), 622–644. https://doi.org/10.1017/S0003055409990128

Pech, G. P., & Caspar, E. A. (2022). Can a video game with a fictional minority group decrease intergroup biases towards non-fictional minorities? A social neuroscience study. *International Journal of Human–Computer Interaction*, 1–15. https://doi.org/10.1080/10447318.2022.2121052

Pech, G. P., Gishoma, D., & Caspar, E. A. (2023). A novel electroencephalography-based paradigm to measure intergroup prosociality: An intergenerational study in the aftermath of the genocide against Tutsis in Rwanda. *Journal of Experimental Psychology General*. https://doi.org/10.1037/xge0001480

Pignatiello, G. A., Martin, R. J., & Hickman, R. L. (2020). Decision fatigue: A conceptual analysis. *Journal of Health Psychology*, *25*(1), 123–135. https://doi.org/10.1177/1359105318763510

Prunier, G. (1998). *The Rwanda crisis: History of a genocide*. C. Hurst & Co. Publishers.

Rouder, J. N., Morey, R. D., Speckman, P. L., & Province, J. M. (2012). Default Bayes factors for ANOVA designs. *Journal of Mathematical Psychology*, *56*(5), 356–374. https://doi.org/10.1016/j.jmp.2012.08.001

Stevens, F., & Taber, K. (2021). The neuroscience of empathy and compassion in pro-social behavior. *Neuropsychologia*, *159*, 107925. https://doi.org/10.1016/j.neuropsychologia.2021.107925

Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33–37). Brooks/Cole.

Tricoche, L., Rovai, A., & Caspar, E. (2024). *When the brain says "No!": An MRI study on the neural correlates of resistance to immoral orders*. PsyArXiv.

Villena-González, M., Palacios-García, I., Rodríguez, E., & López, V. (2018). Beta oscillations distinguish between two forms of mental imagery while gamma and theta activity reflects auditory attention. *Frontiers in Human Neuroscience*, *12*, 12. https://doi.org/10.3389/fnhum.2018.00389

Wagenmakers, E.-J., Verhagen, J., & Ly, A. (2016). How to quantify the evidence for the absence of a correlation. *Behavior Research Methods*, *48*(2), 413–426. https://doi.org/10.3758/s13428-015-0593-0

Zheng, Y., Wang, M., Zhou, S., & Xu, J. (2020). Functional heterogeneity of perceived control in feedback processing. *Social Cognitive and Affective Neuroscience*, *15*(3), 329–336. https://doi.org/10.1093/scan/nsaa028