Cognitive Conflict in Rule Violation and Creativity: Evidence for a Shared Cognitive Basis

Julian Haberler[1,2] | Roland Pfister[3,4] | Moritz Reis[2]

[1]Department of Psychology, Straubing Correctional Facility, Straubing, Germany | [2]Department of Psychology, Julius-Maximilians-University Würzburg, Würzburg, Germany | [3]Department of Psychology, Trier University, Trier, Germany | [4]Institute for Cognitive and Affective Neuroscience, Trier University, Trier, Germany

Correspondence: Julian Haberler (julian.haberler@jv.bayern.de)

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ABSTRACT

Societal traditions and rules guide human decision-making and action. Yet, sometimes humans break with traditions by devising creative solutions and sometimes they break rules to increase personal gains. Here we asked whether creativity and rule-breaking might have more in common than meets the eye, by exploring whether labeling identical actions as either creative or rule-breaking shapes how these actions are semantically processed and cognitively represented. To assess differences in semantic processing we conducted two preregistered experiments, using a mouse-tracking paradigm: Participants of the creativity group either applied a stimulus–response mapping labeled as "traditional", or the opposing mapping labeled as "creative". For the rule violation group, the same behaviors were labeled as "follow rule" and "violate rule". Performance measures indicated a large bias against creative and rule violation options, but this bias did not differ between both groups. This observation indicates that the labels "creative" and "rule-violating" are semantically similarly processed, as both require the agent to overcome automatically retrieved response tendencies.

1 | Introduction

"Works of art make rules; rules do not make works of art" said Claude Debussy,[1] impressionist composer, pianist and—by his own definition—rule-breaker. Indeed, anecdotal evidence indicates that personal creativity and tendencies for rule-violating behavior go hand in hand, with several biographies of various artists including overstepping social norms (Burnham 2002; Holman 2005; Moland 2017).

However, disobeying rules and deviating from traditional pathways often comes with consequences, such as group punishment or exclusion (Garfield et al. 2023; Molho et al. 2020; Petersen et al. 2012). That is, rules as self-enforced behavioral patterns helped us foster cooperation and reduce conflict within groups; hence, they enabled the survival of our species (Chalub et al. 2006; Kenrick et al. 2003; Opp 1982; Ostrom 2000; Young 2015). Traditions, on the other hand, seem to have originated from choice frequencies and rule instructions driven by incentives (Baum et al. 2004), which in turn reduce discomfort caused by uncertainty (Goncalo et al. 2015; Mueller et al. 2012; Grupe and Nitschke 2011; Heider 1958).

At the same time, creative innovation plays a vital role in driving progress and shaping modern society (Hennessey and Amabile 2010). As creativity requires breaking with norms, common sense indicates a potential association with rule violations (as exemplified by Debussy's remark). On a scientific note, research indeed points towards frequent rule-breaking promoting creativity in the workplace (Petrou et al. 2020). Other studies have tried to link creativity to dishonesty, yet with rather mixed results (Beaussart et al. 2013; Reis et al. 2023; Ścigała et al. 2022). Further research has targeted the concept of dark creativity as a direct blend of creative tendencies applied in a rule-breaking

context (Cropley et al. 2012; Gao et al. 2022; Lebuda et al. 2021; Reis, Pfister, and Kunde 2024; Szabó et al. 2022). Regarding the cognitive underpinnings of creativity and rule violations, it was shown that both behaviors induce cognitive conflict for the implementing actor. However, they have been studied mostly separately (Baas et al. 2019; Jusyte et al. 2017; Pfister, Wirth, Schwarz, Steinhauser, and Kunde 2016; Reis, Foerster, et al. 2024; Reis and Kunde 2024; Roskes et al. 2012; Tan et al. 2021).

Our study aimed to combine both concepts. Yet, we focused specifically on the semantic impact of the labels "rule" and "tradition" and their norm-breaching counterparts "rule violation" and "creativity", as specific terms can alter conceptual representation (Lupyan 2012). Moreover, words as the smallest meaningful utterances in language can be compared in the degree of valence, arousal, or dominance (Bradley and Lang 1999; Osgood et al. 1957; Warriner et al. 2013). For example, "creative" might indicate a more positive valence than "rule violation", but "rule violation" might indicate more arousal and dominance than "creative". Based on the reasoning that the labels have different (valence-based) connotations, the present studies aimed to assess whether labelling the same behavior as either "creative" or "rule-violating" induces different levels of cognitive conflict. In a nutshell, we asked two questions: (1) Would merely labelling a response as creative or rule violation result in biases against this response? And (2): How does the size of the ensuing conflict compare between the semantic processing of creativity and rule violation?

Our research topic is based on the findings from previous studies on rule violations indicating that simply labeling an action as rule-breaking has a significant impact on its implementation (Pfister, Wirth, Schwarz, Foerster, et al. 2016; Pfister, Wirth, Schwarz, Steinhauser, and Kunde 2016; Wirth et al. 2016). In these experiments, participants were presented with arbitrary mapping rules, so that one target stimulus would call for a left-going response and another target stimulus would call for a right-going response with the computer mouse. Participants were cued whether to follow or break this mapping rule. Breaking the rule came with substantial cognitive conflict as evident in participants' responses: when labeled as a rule violation, movements were initiated slower than for rule following responses, and movement trajectories during rule violation were systematically torn towards the rule-abiding option (see also Wirth et al. 2018). Crucially, labelling the two types of behaviors as implementing two opposing mapping rules (e.g., "Rule 1" and "Rule 2") reduced this conflict substantially so that the mere label of rule and rule violation had a profound impact on how these actions were cognitively represented and controlled (see also Pfister 2013; Wang and Liu 2024).

While recent research indicates that the mere label "creative" does not have such a strong effect on human behavior (Reis 2025), such research focused on a very specific kind of creativity, which is using objects in alternative functions. The overall impact of labelling a response option as "creative", thus still needs to be explored. In general, recent work on creativity has turned away from merely focusing on how creative ideas are generated (Osborn 1953), towards the question of how creative ideas are selected and implemented (Elsbach 2020; Mueller et al. 2012; Reis, Foerster, et al. 2024; Reis and Kunde 2024). This research question was studied in experimental paradigms similar to the mouse-tracking approach described above. However, participants in these studies were presented with images of everyday objects and were required to select either a traditional or a creative use of this object (Reis et al. 2023). "Creative selections" came with slowed movement initiation and execution, and showed a pronounced attraction to the traditional option in the ensuing movement trajectories. These findings showcase a cognitive bias against creative solutions that seemingly resembles the findings that emerged in the context of rule violations (Pfister, Wirth, Schwarz, Foerster, et al. 2016; Pfister, Wirth, Schwarz, Steinhauser, and Kunde 2016; Wirth et al. 2016).

To assess the semantic impact in the following two experiments, we set up a two-choice action dynamics paradigm based on previous designs using stimulus–response mappings (Pfister 2013; Pfister, Wirth, Schwarz, Steinhauser, and Kunde 2016; Reis, Foerster, et al. 2024; Wirth et al. 2016): Participants were either instructed to apply a stimulus–response mapping cued by geometric figures (SR), or they were instructed to apply the opposing stimulus–response mapping (OSR). The groups differed only in the labels of the instructions, so that the OSR condition was labeled as "creative" for the *creativity group* (compared to the "traditional" SR condition), whereas the OSR was labeled as "rule violation" for the *violation group* (compared to the "rule-following" SR condition). Participants made their response by moving the mouse cursor from the lower center of the screen to one of two target areas in the upper left and right corner of the screen. We then probed for signs of cognitive conflict by analyzing temporal and spatial characteristics of the underlying mouse movements (Pfister et al. 2024).

We expected enhanced cognitive costs for the rule-violating/creative condition compared to the rule-following/traditional condition (Hypothesis 1, H1). However, this bias should be larger for the rule-violating compared to the creativity condition (Hypothesis 2, H2).

Both studies were preregistered (Experiment 1: https://osf.io/jp7vm/?view_only=9c1f5fb4d9d946968f990d0089607a9d; Experiment 2: https://osf.io/934dh/?view_only=b41588b71cfe4a348c2f21141c8b7445) and raw data and analysis code are publicly available (https://osf.io/3y6x2/?view_only=ff72ac2220dc415d990ea23f3a06ceca). The studies conformed to the principles expressed in the Declaration of Helsinki and the guidelines set by the American Psychological Association. According to the ethical guidelines of the German Society for Psychology (DGPs) and the regulations of the local ethics committee, no separate ethics approval was required as all study participants provided informed consent, data were collected anonymously, and there was no foreseeable negative impact on participants.

2 | Experiment 1

2.1 | Introduction

Experiment 1 probed for differences and similarities in semantic processing when actions are labeled as breaking with either traditions or rules exactly as described in the introduction. Our two main research questions were if participants in the creativity

group would exhibit cognitive conflict induced by labeling a response option as "creative" rather than "traditional", and how this conflict related to conflict induced by labeling a response as "rule violation" versus "rule following".

2.2 | Method

2.2.1 | Participants, Power Analysis, and Apparatus

One-hundred participants (50 per group) were recruited via the psychology department's subject pool SONA (82 female, 16 male, two non-binary; age: $M = 22.7$ years, SD = 6.5 years) and either received course credit or volunteered. All participants gave informed consent, were naïve to the hypotheses and purpose of the experiment and were debriefed after the experimental session. This sample size provides a power of at least 1-$\beta = 0.8$ for within-group effects of Cohen's $d_z = 0.40$, and for between-group effects of Cohen's $d = 0.57$, while the effect of creativity amounted to $d_z = 0.43$ in Reis et al. (2023, for area under the curve in their Exp. 1) whereas the effect of rule-breaking amounted to $d_z = 1.61$ in Pfister, Wirth, Schwarz, Foerster, et al. (2016); Pfister, Wirth, Schwarz, Steinhauser, and Kunde (2016), for area under the curve in their Exp. 2.

The experiment was programmed with lab.js (Henninger et al. 2022) using the *mousetrap* plugin (Kieslich and Henninger 2017). Before the experiment, participants were instructed about the task. The computer program enforced full screen mode to ensure undivided attention to the task. Presented texts and stimuli were scaled to meet the individual display resolution of each participant.

2.2.2 | Procedure

Participants conducted a forced-choice action dynamics paradigm (Reis, Foerster, et al. 2024; Reis, Pfister, and Kunde 2024). Cues were four geometric shapes (circle, cross, triangle, rhombus), two of which were mapped to a left response and two of which were mapped to a right response (counterbalanced across participants, with cross and circle on the one hand and triangle and rhombus on the other hand being mapped to the same response).

There were two groups, a creativity group and a rule violation group, that only differed in terms of how the response options were labeled. The procedure in the creativity group was as follows: At first, participants were presented the stimulus–response mapping (SR) referred to as "tradition". The mapping consisted of moving the mouse cursor from the lower center to one of two target areas in the upper left and right corners of the screen. For example, when participants saw a circle or a cross, they had to move the mouse cursor to the right target area; a triangle and a rhombus indicated movement to the left target area. Trials requiring the opposing S-R mapping (OSR) were signaled by the command "creative". The rule violation group was identical with the only difference that the introduced SR mapping was labeled as "follow rule", while the OSR was signaled by the command "violate rule" Figure 1. shows the procedure of a trial. In total, participants conducted five blocks with 24 trials each with 50% SR and 50% OSR trials.

2.3 | Design

We applied a 2×2 design with the between-factor labelling group ("creativity" vs. "rule violation") and the within-factor conformity (SR vs. OSR). We analyzed four dependent variables representing cognitive conflict in action implementation processes: mean hit rates (share of correct responses), the decision time required to leave the home area and start the action (initiation time; IT), the time from leaving the home area until approaching the center of a target area to ≤20 px; hence, the time the action takes to be implemented (movement time; MT), and the area under the curve (AUC), representing the area between the actual movement

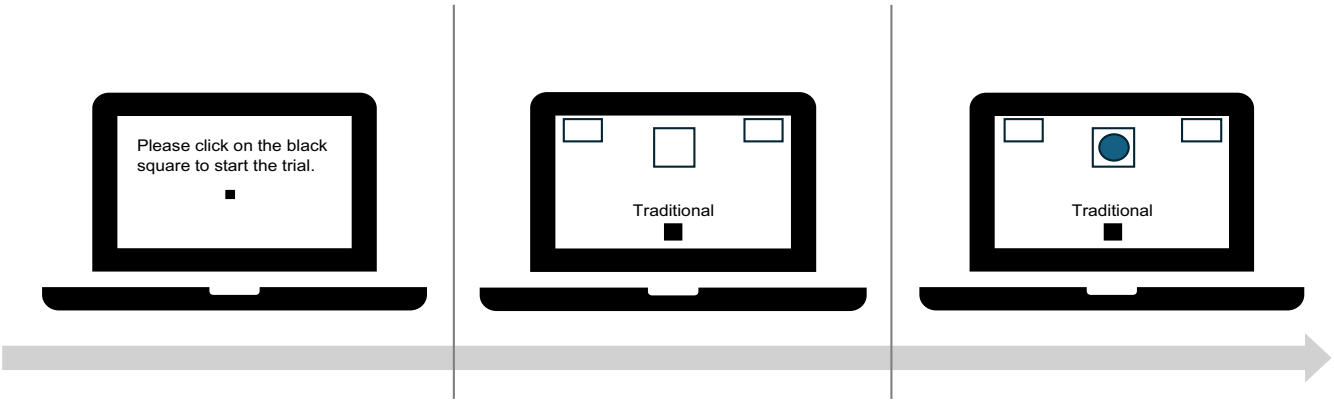

FIGURE 1 | Exemplary trial procedure of the creativity group of Experiment 1. Two geometric figures were assigned to each target area at the upper left and right corner of the screen. A command indicated whether to follow the stimulus–response mapping (SR, cued as "traditional") or to respond opposite to this mapping (OSR, cued as "creative"). The procedure of the rule violation group was identical except that we used the labels "follow rule" (SR) and "violate rule" (OSR). Participants started each trial by clicking on a black square in the screen center. The two upper target areas and a squared placeholder for the cue (geometric figure) appeared in the upper center of the screen together with the home area in the bottom center and the command directly above the home area. By clicking on the home area, the cue appeared on the screen indicating the correct target area, and participants were instructed to respond according to the cue and the command by applying either the original stimulus–response mapping (SR) or the opposing mapping (OSR).

trajectory and a straight line from start to endpoint.[2] To account for varying screen sizes, all trajectories were scaled to a uniform display resolution with the distance of 100 x-units (xu) from the center of the home area to the center of each target area on the x-axis and 200 xu on the y-axis. Moreover, all left-going trajectories were mirrored to the right. All trajectories were time-normalized from movement onset to reaching the target area to 101 points using linear interpolation. We compensated for varying click times by appending the last coordinate of the movement after time normalization. AUC was then determined as the signed area between this trajectory and a straight line from start to endpoint of the scaled movement (in xu^2).

2.4 | Results

2.4.1 | Preprocessing and Data Analyses

Trials in which IT, MT or AUC deviated more than 2.5 SD from their corresponding cell mean were excluded. Error trials (choosing the wrong target area) and trials with less than three datapoints were also excluded. In total, 12.9% of all trials had to be excluded. Participants with less than 10 correct trials per condition were fully excluded, which applied to one subject.[3]

We calculated separate mixed analyses of variance (ANOVAs) for mean hit rates, ITs, MTs, and AUCs, using labelling group as a between-subjects factor and conformity as a within-subjects factor. Follow-up *t*-tests were computed for significant interactions. For exploratory analyses, we calculated additional ANOVAs for each measure, for which we added the factor "experimental block". We aimed to assess whether the labelling effect changed throughout the study. Note that the exploratory analyses were not preregistered.

TABLE 1 | Hit rates for both labelling groups in Experiment 1.

Groups	Creativity	Rule violation
SR		
M	94.13	96.27
SD	13.88	9.63
OSR		
M	92.30	92.27
SD	13.33	16.26

Note: Mean hit rates (*M*) and standard deviations (SD) for the creativity group and the rule violation group of Experiment 1 (in %). Commands indicated whether to apply the introduced S-R mapping (SR) or respond opposite (OSR). The introduced mapping was either labeled as "tradition" (in the creativity group) or as "rule" (in the violation group).

2.4.2 | Hit Rates, Initiation Times, Movement Times, Areas Under the Curve

Mean hit rates for all conditions can be found in Table 1. Figure 2 shows mean ITs, MTs, and AUCs for each experimental condition (see Appendix S1 for detailed descriptive statistics).

2.4.2.1 | Hit Rates. The main effect of labeling group was statistically nonsignificant, $F(1, 98) = 0.18$, $p = 0.674$, $\eta_p^2 < 0.01$. However, in line with H1, conformity yielded a statistically significant effect, with higher values for SR compared to OSR trials, $F(1, 98) = 7.79$, $p = 0.006$, $\eta_p^2 = 0.07$. In contrast to H2, the interaction between labeling group and conformity was statistically nonsignificant, $F(1, 98) = 1.08$, $p = 0.302$, $\eta_p^2 < 0.01$.

2.4.2.2 | Initiation Time. There was no statistically significant main effect regarding labelling group, $F(1, 97) = 0.58$, $p = 0.448$, $\eta_p^2 = 0.01$. In contrast to H1, the main effect of conformity within conditions was statistically nonsignificant, $F(1, 97) = 0.66$, $p = 0.419$, $\eta_p^2 = 0.01$. In contrast to H2, the interaction between labelling group and conformity was also statistically nonsignificant, $F(1, 97) = 0.02$, $p = 0.887$, $\eta_p^2 < 0.01$.

2.4.2.3 | Movement Time. There was no statistically significant main effect for labelling group, $F(1, 97) < 0.00$, $p = 0.946$, $\eta_p^2 < 0.01$. In line with H1, the main effect of conformity was statistically significant, with lower values for SR compared to OSR trials, $F(1, 97) = 67.86$, $p < 0.001$, $\eta_p^2 = 0.4$. In contrast to H2, the interaction between labelling group and conformity was not statistically significant, $F(1, 97) = 0.53$, $p = 0.468$, $\eta_p^2 = 0.01$.

2.4.2.4 | Area Under the Curve. There was no statistically significant main effect of labelling group, $F(1, 97) = 0.06$, $p = 0.813$, $\eta_p^2 < 0.01$, but in line with H1, AUCs were statistically significantly higher for OSR compared to SR trials $F(1, 97) = 133.93$, $p < 0.001$,

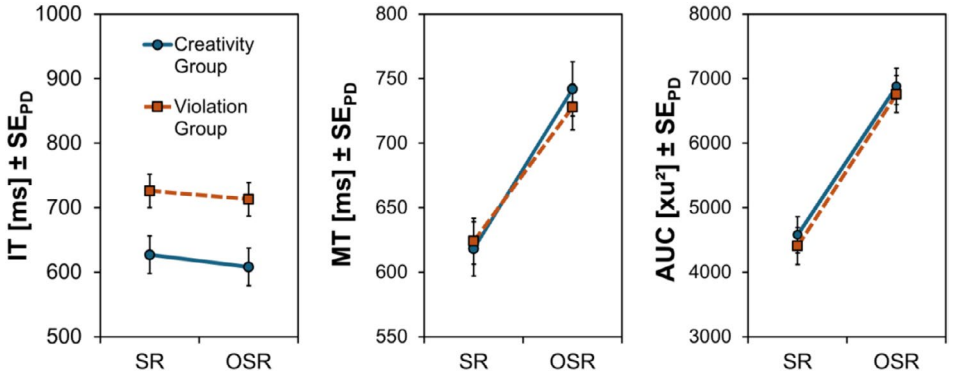

FIGURE 2 | Mean initiation times (ITs), movement times (MTs), and area under the curve (AUCs) for both labelling groups when implementing an instructed stimulus–response mapping (SR) as compared to responding opposite to this mapping (OSR) in Experiment 1. Error bars indicate standard errors of paired differences (Pfister and Janczyk 2013), computed separately for each labelling group.

$\eta_p^2 = 0.58$. Once again, in contrast to H2, the interaction between labelling group and conformity was not statistically significant, $F = (1, 97) = 0.02$, $p = 0.895$, $\eta_p^2 < 0.01$.

2.4.3 | Exploratory Analyses

2.4.3.1 | Hit Rates. There was a statistically significant main effect of experimental block, $F(4, 392) = 11.67$, $p < 0.001$, $\eta_p^2 = 0.11$. The interaction between labelling group and experimental block was statistically significant, $F(4, 392) = 2.98$, $p = 0.032$, $\eta_p^2 = 0.03$. The interaction between conformity and experimental block, $F(4, 392) = 1.85$, $p = 0.129$, $\eta_p^2 = 0.02$, and the three-way interaction between labelling group and conformity across blocks was not statistically significant, $F(4, 392) = 2.07$, $p = 0.095$, $\eta_p^2 = 0.02$.

2.4.3.2 | Initiation Time. There was a statistically significant main effect of experimental block, $F(4, 388) = 3.94$, $p = 0.013$, $\eta_p^2 = 0.04$. The interaction between labelling group and experimental block was not statistically significant, $F(4, 388) = 0.09$, $p = 0.950$, $\eta_p^2 < 0.01$, neither between conformity and block number, $F(4, 388) = 0.44$, $p = 0.705$, $\eta_p^2 < 0.01$. The interaction between labelling group and condition across blocks was not statistically significant, $F(4, 388) = 0.72$, $p = 0.527$, $\eta_p^2 = 0.01$.

2.4.3.3 | Movement Time. There was a statistically significant main effect of experimental block, $F(4, 388) = 4.65$, $p = 0.009$, $\eta_p^2 = 0.05$. The interactions between labelling group and experimental block, $F(4, 388) = 0.37$, $p = 0.702$, $\eta_p^2 < 0.01$, and conformity and experimental block were not statistically significant, $F(4, 388) = 0.74$, $p = 0.509$, $\eta_p^2 = 0.01$. The three-way interaction between labelling group, conformity, and experimental block was not statistically significant, $F(4, 388) = 0.74$, $p = 0.512$, $\eta_p^2 = 0.01$.

2.4.3.4 | Area Under the Curve. There was no statistically significant main effect of experimental block, $F(4, 388) = 0.63$, $p = 0.598$, $\eta_p^2 = 0.01$, nor a statiscally significant interaction between labelling group and experimental block, $F(4, 388) = 0.72$, $p = 0.544$, $\eta_p^2 = 0.01$., nor between conformity and experimental block, $F(4, 388) = 1.43$, $p = 0.232$, $\eta_p^2 = 0.01$. Likewise, the three-way interaction was not statistically significant, $F(4, 388) = 1.11$, $p = 0.348$, $\eta_p^2 = 0.01$.

2.5 | Discussion

In Experiment 1, we used a mouse-tracking paradigm to study the impact of labelling a behavior as either a creative breach of tradition (creativity group) or as a rule violation (violation group). As expected, we observed creativity and rule-breaking labels inducing performance costs compared to the respective control condition. This pattern is particularly remarkable because creativity and rule violation occurred equally often as traditional and rule-based responses, thus excluding any alternative explanations in terms of frequency of applying a certain mapping. These observations indicate that labelling has a profound impact on how these responses were represented, yielding cognitive conflict whenever participants were instructed to oppose an instructed stimulus–response mapping. Surprisingly, the size of this conflict was comparable between both groups, suggesting that creativity and rule violation are remarkably similar in inducing conflict. Strengthening this assumption, both concepts did not differ in how respective effects developed over time, as our exploratory analyses indicated.

Finally, the similarity of both concepts receives further support from Bayesian analyses, with Bayes Factors for the interaction of conformity and labelling group regarding ITs, MTs and AUCs at $BF_{10} \leq 0.25$ (we used medium default priors, repeated each Bayesian analysis 100 times and report corresponding medians to account for variability in Bayes Factor estimates; see Pfister 2021, 2024).

3 | Experiment 2

3.1 | Introduction

Experiment 1 showed cognitive conflict when acting contrary to traditions or rules, while labelling a behavior as "creative" yielded the same consequences as labelling a behavior as "rule violation". A first aim of Experiment 2 was to replicate these results. As a second aim, we wanted to test these findings against a more neutral labelling of the response option by adding two additional groups in which SR and OSR were both described as traditional or rule-following responses respectively (corresponding to the labelling approach in Pfister, Wirth, Schwarz, Foerster, et al. 2016; Pfister, Wirth, Schwarz, Steinhauser, and Kunde 2016 and Wirth et al. 2016). Based on previous findings, we expected a strong label effect in the "norm breaching" groups (creativity and rule violation), while the equivalent norms, represented by Tradition 1/Tradition 2 and Rule 1/Rule 2, should result in reduced cognitive conflict. An overview of factors and associated task sets of Experiment 2 can be found in Table 2.

3.2 | Method

3.2.1 | Participants, Power Analysis, Apparatus, Stimuli and Procedure

A total of 104 participants (65 female, 34 male, three non-binary, two preferred not to disclose their gender; $M = 31.5$ years, $SD = 12.3$ years) was recruited via the psychology department's

TABLE 2 | Overview of factors and task sets of Experiment 2.

Groups	Creativity		Violation		Multiple traditions		Multiple rules	
Commands	"Tradi-tional"	"Creative"	"Follow rule"	"Violate rule"	"Tradition 1"	"Tradition 2"	"Rule 1"	"Rule 2"
Conformity	SR	OSR	SR	OSR	SR1	SR2	SR1	SR2

Note: SR, SR1 = responding according to instructed stimulus–response mapping; OSR, SR2 = responding opposite to instructed stimulus–response mapping.

subject pool SONA and via Prolific (www.prolific.com; 15 different nationalities with the UK (44%) and Germany (32%) mentioned most frequently). All participants gave informed consent, were naïve to the hypotheses of the experiment and were debriefed after the session. We based our sample size calculation again on an effect size of $d_z = 0.50$ with 34 subjects in the tradition- and rule-based group (power of $1-\beta = 80\%$; $\alpha = 0.05$, two-tailed testing; calculated with the power.t.test function in the statistics package R, version 4.4.1). To counteract dropout rates around 15% (as in Experiment 1) and increase power to assess the main and interaction effects of framing (hence, subdividing both groups) the total sample size was increased to 104 subjects.

The experiment was identical to Experiment 1 with a creativity group and a rule violation group. Additionally, we now included multiple traditions and a multiple rules group as well. The multiple traditions group received the commands "tradition 1" (SR1, replacing the SR condition of the creativity group) and "tradition 2" (SR2, replacing the OSR condition of the creativity group). The multiple rules group received the commands "rule 1" (SR1) and "rule 2" (SR2). Again, the instructions were identical for participants of all four groups, differing only in the labelling (tradition- or rule-based) and the commands. Importantly, this meant that the two new groups also were only presented with one mapping (SR1), whereas the other mapping was introduced as the negation of this mapping (see Wirth et al. 2016, for a similar procedure).

3.2.2 | Design

Experiment 2 had a 2×2×2 design with the between factors labelling group (tradition vs. rule) and framing (SR/OSR vs. SR1/SR2) and the within-factor conformity (SR vs. OSR for the creativity group and the rule violation group; SR1 vs. SR2 for the multiple traditions group and the multiple rules group).

3.3 | Results

3.3.1 | Preprocessing, Data Exclusions and Analyses

Preprocessing steps and exclusion criteria were similar to Experiment 1. Datasets of six participants were fully excluded for the analyses of IT, MT, and AUC. We calculated a three-way mixed ANOVA for each dependent variable (hit rates, IT, MT, and AUC), using labelling group, framing, and conformity as factors. For the analyses of IT, MT, and AUC, we excluded 21.3% of the trials based on the same exclusion criteria as for Experiment 1.

3.3.2 | Hit Rates, Initiation Times, Movement Times, Areas Under the Curve

Table 3 shows mean hit rates of all groups, and Figure 3 shows descriptive results for all remaining measures (ITs, MTs, AUCs; see Appendix S1 for full descriptive statistics).

3.3.2.1 | Hit Rates. The main effects of labelling group, $F(1,100) = 3.58$, $p = 0.061$, $\eta_p^2 = 0.03$, and framing, $F(1,100) = 0.23$, $p = 0.634$, $\eta_p^2 < 0.01$, were statistically nonsignificant. Conformity yielded a statistically significant main effect, $F(1,100) = 4.80$, $p = 0.031$, $\eta_p^2 = 0.05$, with lower hit rates for OSR and SR2 compared to SR and SR1 trials. The interactions of labelling group and framing, $F(1,100) < 0.01$, $p = 0.994$, $\eta_p^2 < 0.01$, labelling group and conformity, $F(1,100) = 2.54$, $p = 0.114$, $\eta_p^2 = 0.02$, and framing and conformity were not statistically significant, $F(1,100) = 1.24$, $p = 0.269$, $\eta_p^2 = 0.01$. The three-way interaction was not statistically significant either, $F(1,100) = 0.01$, $p = 0.923$, $\eta_p^2 < 0.01$.

3.3.2.2 | Initiation Time. There was no statistically significant main effect of labelling group, $F(1,94) = 0.20$, $p = 0.657$, $\eta_p^2 < 0.01$, but a statistically significant main effect of framing, $F(1,94) = 4.54$, $p = 0.036$, $\eta_p^2 = 0.05$, with higher ITs for the creativity group and the rule violation group as compared to the multiple traditions and multiple rules group. The main effect conformity was also statistically significant, $F(1,94) = 4.82$, $p = 0.031$, $\eta_p^2 = 0.05$, with higher ITs for OSR and SR2 compared to SR and SR1 trials. The interaction between labelling group and framing was not statistically significant, $F(1,94) = 0.10$, $p = 0.753$, $\eta_p^2 < 0.01$. There was also no statistically significant interaction between labelling group and conformity, $F(1,94) < 0.01$, $p = 0.948$, $\eta_p^2 < 0.01$. Moreover, the interaction between framing and conformity was not statistically significant, $F(1, 94) = 0.10$, $p = 0.763$, $\eta_p^2 < 0.01$. The three-way interaction was not statistically significant either, $F(1,94) = 0.76$, $p = 0.386$, $\eta_p^2 = 0.01$.

3.3.2.3 | Movement Time. The main effect of labelling group was not statistically significant, $F(1,94) = 1.84$, $p = 0.178$, $\eta_p^2 = 0.02$, and neither was the main effect of framing,

TABLE 3 | Mean hit rates [%] and standard deviations of all groups in Experiment 2.

Groups	Creativity	Violation	Multiple traditions	Multiple rules
SR/SR1				
M	83.21	88.33	83.53	88.33
SD	24.96	25.15	22.76	19.12
OSR/SR2				
M	78.08	89.17	73.59	85.13
SD	29.67	18.17	30.57	19.64

Note: SR and OSR refer to the creativity and the rule violation group; SR1 and SR2 refer to the multiple traditions and multiple rules group.

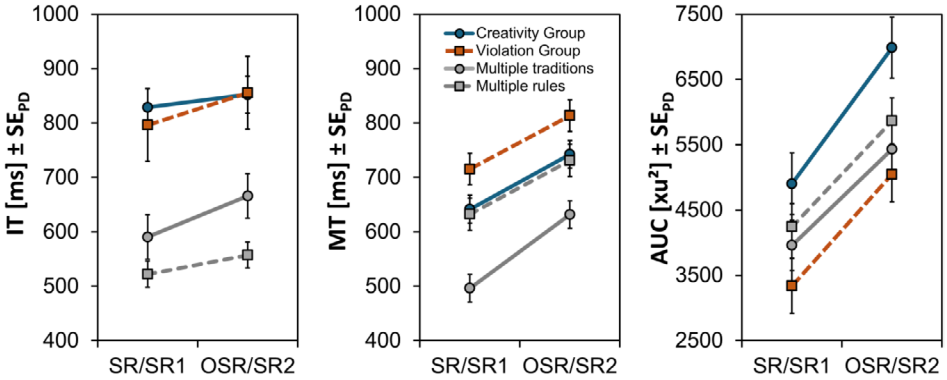

FIGURE 3 | Mean initiation time (IT), movement time (MT), area under the curve (AUC) for all groups of Experiment 2, accompanied by standard errors for paired differences (SE_{PD}) that were computed separately for each labelling group. SR indicates responses according to an instructed mapping (including SR1 for the multiple traditions group and the multiple rules group), whereas OSR indicates responses opposite to the instructed mapping (including SR2 for the multiple traditions group and the multiple rules group).

$F(1,94)=2.22$, $p=0.140$, $\eta_p{}^2=0.02$. However, a statistically significant effect of conformity on MTs was observed, $F(1,94)=61.21$, $p<0.001$, $\eta_p^2=0.39$, with higher values for OSR and SR2 compared to SR and SR1 trials. The interaction between labelling group and framing was not statistically significant, $F(1,94)=0.10$, $p=0.750$, $\eta_p^2<0.01$. Moreover, there was no statistically significant interaction between labelling group and conformity, $F(1,94)=0.53$, $p=0.469$, $\eta_p^2=0.01$, and neither between framing and conformity, $F(1,94)=0.39$, $p=0.5324$, $\eta_p^2<0.01$. Also, the three-way interaction was not statistically significant, $F(1,94)=0.39$, $p=0.535$, $\eta_p^2<0.01$.

3.3.2.4 | Area Under the Curve. The main effects of labelling group, $F(1,94)=1.00$, $p=0.319$, $\eta_p^2=0.01$, and framing, $F(1,94)=0.07$, $p=0.799$, $\eta_p^2<0.01$, on AUCs were not statistically significant. However, once again, a strong statistically significant main effect of conformity was found, $F(1,94)=70.99$, $p<0.001$, $\eta_p^2=0.43$, with higher values for OSR and SR2 compared to SR and SR1 trials. The interaction of labelling group and framing was not statistically significant, $F(1,94)=2.45$, $p=0.121$, $\eta_p^2=0.03$; neither was the interaction between labelling group and conformity, $F(1,94)=0.07$, $p=0.793$, $\eta_p^2<0.01$; and also the interaction between framing and conformity showed no statistically significant effect, $F(1,94)=0.71$, $p=0.403$, $\eta_p^2=0.01$. The three-way interaction was not statistically significant either, $F(1,94)=0.40$, $p=0.526$, $\eta_p^2<0.01$.

3.3.3 | Exploratory Analyses

Like in Experiment 1, we calculated additional ANOVAs for each measure, for which we added the factor "experimental block" to assess whether the labelling effect changed throughout the study. Note that these exploratory analyses were not preregistered.

3.3.3.1 | Hit Rates. There was a statistically significant main effect of experimental block, $F(4, 400)=4.64$, $p=0.007$, $\eta_p^2=0.04$. The interaction between labelling group and experimental block was not statistically significant, $F(4, 400)=0.83$, $p=0.456$, $\eta_p^2=0.01$. The interaction between framing and experimental block was not statistically significant, $F(4, 400)=1.41$, $p=0.244$, $\eta_p^2=0.01$, and there was no statistically significant interaction between conformity and experimental block, $F(4, 400)=1.17$, $p=0.318$, $\eta_p^2=0.01$. The three-way interaction between labelling group, framing, and block number did not reach statistical significance, $F(4, 400)=1.77$, $p=0.165$, $\eta_p^2=0.02$. The interaction between framing and conformity across blocks was not statistically significant, $F(4, 400)=1.65$, $p=0.185$, $\eta_p^2=0.02$. There was no statistically significant interaction between labelling group and conformity across blocks, $F(4, 400)=0.35$, $p=0.760$, $\eta_p^2<0.01$. Finally, the four-way interaction among labelling group, framing, condition, and experimental block was also not statistically significant, $F(4, 400)=0.38$, $p=0.743$, $\eta_p^2<0.01$.

3.3.3.2 | Initiation Time. There was a statistically significant main effect of experimental block, $F(4, 176)=4.18$, $p=0.014$, $\eta_p^2=0.09$. The interactions between labelling group and experimental block, $F(4, 176)=1.55$, $p=0.215$, $\eta_p^2=0.03$, framing and experimental block, $F(4, 176)=0.63$, $p=0.556$, $\eta_p^2=0.01$, and conformity and experimental block, $F(4, 176)=1.10$, $p=0.346$, $\eta_p^2=0.02$, remained statistically nonsignificant. Furthermore, the three-way interaction between labelling group, framing, and experimental block was statistically nonsignificant, $F(4, 176)=0.55$, $p=0.603$, $\eta_p^2=0.01$. The interaction between labelling group and conformity across blocks did not reach statistical significance, $F(4, 176)=2.31$, $p=0.091$, $\eta_p^2=0.05$. Likewise, the interaction between framing and condition across blocks was not statistically significant, $F(4, 176)=0.72$, $p=0.521$, $\eta_p^2=0.02$., nor the four-way interaction among labelling group, framing, condition, and experimental block, $F(4, 176)=0.37$, $p=0.742$, $\eta_p^2=0.01$.

3.3.3.3 | Movement Time. There was a statistically significant main effect of experimental block, $F(4, 176)=6.21$, $p=0.004$, $\eta_p^2=0.12$. The interactions between labelling group and experimental block, $F(4, 176)=1.46$, $p=0.239$, $\eta_p^2=0.03$, framing and experimental block, $F(4, 176)=1.63$, $p=0.205$, $\eta_p^2=0.04$, and conformity and experimental block, $F(4, 176)=0.44$, $p=0.639$, $\eta_p^2=0.01$, were not statistically significant.

Furthermore, the three-way interaction between labelling group, framing, and experimental block was statistically nonsignificant, $F(4, 176) = 0.16$, $p = 0.839$, $\eta_p^2 < 0.01$. The interaction between labelling group and conformity across blocks did not yield statistical significance, $F(4, 176) = 2.49$, $p = 0.090$, $\eta_p^2 = 0.05$. The interactions between framing and conformity across blocks, $F(4, 176) = 0.54$, $p = 0.579$, $\eta_p^2 = 0.01$, and between labelling group, framing, conformity and experimental block did not yield statistical significance, $F(4, 176) = 1.87$, $p = 0.162$, $\eta_p^2 = 0.04$.

3.3.3.4 | Area Under the Curve. There was no statistically significant main effect of experimental block, $F(4, 176) = 0.63$, $p = 0.568$, $\eta_p^2 = 0.01$. The interaction between labelling group and experimental block was statistically significant, $F(4, 176) = 2.98$, $p = 0.043$, $\eta_p^2 = 0.06$. The interaction between framing and block number was not statistically significant, $F(4, 176) = 1.20$, $p = 0.309$, $\eta_p^2 = 0.03$, neither was the interaction between condition and experimental block, $F(4, 176) = 0.41$, $p = 0.801$, $\eta_p^2 = 0.01$. The three-way interaction between labelling group, framing and experimental block was also statistically nonsignificant, $F(4, 176) = 0.88$, $p = 0.437$, $\eta_p^2 = 0.02$. The interaction between labelling group and conformity across blocks did not reach statistical significance, $F(4, 176) = 1.82$, $p = 0.126$, $\eta_p^2 = 0.04$. Likewise, the interaction between framing and conformity across blocks was statistically nonsignificant, $F(4, 176) = 0.73$, $p = 0.571$, $\eta_p^2 = 0.02$, and the four-way interaction among labelling group, framing, conformity and experimental block was statistically nonsignificant, $F(4, 176) = 2.03$, $p = 0.093$, $\eta_p^2 = 0.04$.

3.4 | Discussion

In Experiment 2, we replicated the findings of Experiment 1 indicating no statistically significant differences in cognitive conflict for actions labeled as "creative" and "rule-violating". Again, this outcome was supported by Bayesian analyses, with Bayes Factors for the interaction of conformity and labelling group regarding ITs, MTs and AUCs at $BF_{10} \leq 0.23$ (we report medians of Bayes Factor estimates for 100 repetitions using medium default priors; see Pfister 2021, 2024). Also in line with the findings of Experiment 1, our exploratory analyses indicated no statistically significant differences for the development of these interaction effects over time.

However, cognitive conflict was also visible in the two groups that received two equally acceptable traditions or rules to work with. This seemingly stands in contrast to our hypothesis based on previous findings where using a reversed rule yielded diminished or even absent differences between different rules (Pfister, Wirth, Schwarz, Foerster, et al. 2016; Pfister, Wirth, Schwarz, Steinhauser, and Kunde 2016). For the present design, it is important to note that the SR2 mappings were never presented to the participants, so that they were likely represented as a negated version of the SR1 mapping. Some previous studies indicate that such an instruction comes with similar effects as a rule violation instruction (Imhof and Rüsseler 2019), whereas other findings have pointed to prevailing differences between rule violations and rule negations (Wirth et al. 2016). In the case of the present experiments, we cannot exclude the possibility that our online setup led participants in the multiple traditions and multiple rules group to only encode the first tradition or rule so that responses according to the SR2 mapping were not represented as own traditions or rules but rather as derived from the firmly encoded SR1 mapping (Pereg and Meiran 2021). Furthermore, we might have lacked statistical power for this specific comparison. Our general discussion, therefore, focuses on the label effect (SR vs. OSR) and its difference between the creativity and the rule violation group.

4 | General Discussion

Within the present study, we explored whether labelling an identical action as either "creative" or "rule violating" affects how this action is semantically processed. Our results indicate that "creative" and "rule violating" labels come with enhanced cognitive conflict relative to trials with compliant labels, yet this conflict is of similar size for both kinds of non-compliance. This observation is remarkable because the term "rule" seems to imply a more dogmatic concept relative to "tradition", associated with often severe consequences such as punishment (Garfield et al. 2023; Greenawalt 1983; Rawls 1955).

Cognitive theories of rule violation behavior are usually based on research about negation (Wirth et al. 2016) suggesting a representation of the non-negated concept, and only in a second step the application of the negation (Clark and Chase 1972; Gilbert 1991; Strack and Deutsch 2004; Wegner et al. 1985). A similar mechanism could apply to creativity: Even though associated with many benefits and desirable traits, creative behavior includes social risks for the actor (Birney et al. 2016). Traditions provide security, demand less cognitive resources, and might retrieve automatic responses due to script activations: A key opens doors, and only at second thought, crown caps.

In any case, the present results document a striking and pervasive influence of labelling on how actions are cognitively represented and semantically processed. These conclusions echo findings from motivational psychology where action labels have been found to reverse affective mapping effects between affective stimuli and body movements (Eder and Rothermund 2008). Participants in this study were shown negative or positive word stimuli and responded to these with push and pull movements of a joystick. One half of the participants was instructed to move the joystick "towards" or "away" from themselves whereas the other half of the participants was instructed to move the joystick "downwards" or "upwards" so that identical body movements received diverging labels. This seemingly subtle change had profound effects ($\eta^2 = 0.41$) on how movements were carried out: participants in the former group were faster to perform a pull movement to positive words than to negative words ($d_z = 0.80$), whereas this effect reversed for the latter group ($d_z = 0.77$). The present results indicate that also labelling a behavior as "creative" (i.e., non-traditional) or "rule violation" significantly affects the action representation in the cognitive system.

Yet, it should be noted that defining an action as "creative" only because it is contrary to an instruction may not perfectly align with common understandings of creativity. However, examining creativity per se was not our objective. Rather, our aim was to assess potential bias towards the label "creative", independent of the action itself. To achieve this goal, it was necessary to compare two kinds of actions, as similar to each other as possible.

A further possible limitation of our study is that similarities between labelling groups (creative vs. rule-violating) regarding the conformity effect (SR vs. OSR) may be due to a ceiling effect in task difficulty.

Another notable observation is that the present data showed cognitive conflict mainly in measures relating to how responses are executed, i.e., in MTs and AUCs of the ensuing movement. Measures of response initiation, i.e., ITs, were less affected. This contrasts with previous findings in which IT effects were substantial, and cognitive conflict sometimes even exclusively emerged in this measure (Jusyte et al. 2017). It is an open question whether the online setting of the present experiments is responsible for this pattern or whether other, subtle features of the task design prompted participants to adopt a rather progressive criterion for initiating a response (e.g., immediately starting the movement before even processing the stimuli and response options).

In the current design, we instructed participants to conduct actions labeled as creative or rule-violating. Especially rule-violating behavior, however, usually occurs in an unsolicited manner, driven by an agent's motivation to expedite task performance or attain rewards (Gross et al. 2018; Pfister et al. 2019). Whether the present results extend to such unsolicited choices of either creative or rule-violating behavior remains to be studied.

In addition, creativity and rule violation might differ in temporal aspects. One could argue that rules could be more consistent over time, as a rule does not change despite agents acting contrary to this rule. Creative behavior, by contrast, is more temporally dynamic, and becomes yet another tradition if implemented sufficiently often. Interestingly, a recent study found that cognitive costs of opting for creative options were not reduced by mere repetition of novel alternatives (Reis and Kunde 2024). Our exploratory analyses support these findings, as we could not detect any meaningful differences regarding how respective effects develop over time. As we, however, only assessed the influence of respective labels, future research should test for temporal differences when repeatedly implementing creative and rule-violating actions.

5 | Conclusion

This study aimed to examine cognitive consequences of labelling identical actions as creative or rule violating. We compared the extent of cognitive conflict when deviating from an arbitrary stimulus–response mapping labeled as either "tradition" or "rule". The findings indicated that semantic processing of both terms yields similar biases towards conformity. These results provide further evidence that both traditions and rules create powerful cognitive barriers, and consequently, hinder implementation of novel ideas in the case of creativity. Rules truly do not make works of art, it seems. Rather, creativity and rule-breaking share remarkably similar cognitive mechanisms.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are openly available in The Open Science Framework at https://osf.io/3y6x2/files/osfstorage?view_only=ff72ac2220dc415d990ea23f3a06ceca.

Endnotes

[1] The quote is attributed to the French composer Claude Debussy (1862–1918) but cannot be tracked to its original source. However, his compositions were remarkably progressive, shattered the aesthetic and technical boundaries of his time and could have led to this attribution. His avant-garde influence continues to resonate today (Pasler 2012).

[2] [2] AUC can be understood as a measure of the spatial bias towards the opposing response option: If there is no bias, the trajectory should be a relatively straight line to the target. If there is a bias towards the opposing response option, the curvature of the movement quantifies the strength of this bias. The stronger cognitively represented, the more powerful the pull towards the opposing response option should be (for further explanations of this design, see i.e., Stillman et al. 2018; Pfister et al. 2024; Wirth et al. 2016).

[3] Note that the analysis of hit rates was conducted before any exclusions.

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