SIMILARITY AND AUTOMATIC IMITATION

A direct test of the similarity assumption —

Focusing on differences as compared with similarities decreases automatic imitation

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Abstract

Individuals automatically imitate a wide range of different behaviors. Previous research suggests that imitation as a social process depends on the similarity between interaction partners. However, some of the experiments supporting this notion could not be replicated and all of the supporting experiments manipulated not only similarity between actor and observer, but also other features. Thus, the existing evidence leaves open whether similarity as such moderates automatic imitation. To directly test the similarity account, in four experiments, we manipulated participants' focus on similarities or differences while holding the stimulus material constant. In Experiment 1, we presented participants with a hand and let them either focus on similarities, differences, or neutral aspects between their own hand and the other person's hand. The results indicate that focusing on similarities increased perceived similarity between the own and the other person's hand. In Experiments 2 to 4, we tested the hypothesis that focusing on similarities, as compared with differences, increases automatic imitation. Experiment 2 tested the basic effect and found support for our prediction. Experiment 3 and 4 replicated this finding with higher-powered samples. Exploratory investigations further suggest that it is a focus on differences that decreases automatic imitation, and not a focus on similarities that increases automatic imitation. Theoretical implications and future directions are discussed.

Keywords. Automatic imitation, similarity, comparison processes, motor learning

Past research has shown that individuals automatically imitate a wide range of different behaviors including facial expressions (Dimberg, 1982), characteristics of language (Cappella & Planalp, 1981; Giles & Powesland, 1975; Webb, 1969, 1972), emotions (Chartrand & Bargh, 1999; Dimberg, 1982), postures (LaFrance, 1982), gestures (Bernieri, 1988; Cracco, Genschow, et al., 2018), and simple movements (Genschow & Florack, 2014; Genschow et al., 2013; Genschow, Hansen, et al., 2019). It has been argued that such imitative behavior serves as a “social glue” (for a review, see Wang & Hamilton, 2012), because it fosters a prosocial orientation (Kavanagh & Winkielman, 2016; Lakin et al., 2008; Stel et al., 2008; van Baaren, Holland, et al., 2004), empathy (Carr et al., 2014; Iacoboni, 2009), liking for each other (Sparenberg et al., 2012), and perspective taking (Lamm et al., 2007; Lamm et al., 2008)—to name just a few examples. A frequent assumption and basis for many arguments in this research is that automatic imitation hinges on the similarity of interaction partners. Here, we report research putting this conjecture to a direct test.

Within research on imitation, different fields use different paradigms (for definitions see Genschow et al., 2017). For example, with reference to the so-called chameleon effect, social psychologists investigate mimicry—individuals’ tendency to imitate others in social settings. Mimicry has most often been investigated by applying naturalistic paradigms that measure the frequency of imitation in interactions between a participant and a confederate (e.g., Chartrand & Bargh, 1999; Lakin et al., 2008; Stel, van Baaren, et al., 2010; Stel, Blascovich, et al., 2010; van Baaren et al., 2009; van Baaren, Horgan, et al., 2004).

In contrast to such naturalistic paradigms, other researchers investigate automatic imitation with the imitation-inhibition task (Brass et al., 2001; Brass et al., 2000; for a meta-analysis see Cracco, Bardi, et al., 2018)—a laboratory model of imitation (Heyes,

2011). In the imitation-inhibition task, participants respond over many trials with two different movements to two different imperative cues while observing either a congruent or an incongruent movement. For example, participants are instructed to respond to the number '1' or '2' by lifting their index or middle finger. At the same time, participants see another person lifting either the same (i.e., congruent movement) or the other finger (i.e., incongruent movement). Automatic imitation in such a paradigm refers to the finding that individuals respond faster and with fewer errors to congruent movements than to incongruent ones. Past research has demonstrated that automatic imitation paradigms are a valid measure of imitation (Cracco & Brass, 2019) and produce larger and more reliable effects than mimicry tasks (Genschow et al., 2017).

Irrespective of the applied method, it is assumed that imitative behavior is based on a so-called perception-action link. According to such a link, the visual image of an action is part of its motor representation (Greenwald, 1970; Jeannerod et al., 1995; Prinz, 1990, 1997). That is, the observation of an action activates the same representation as the execution of that action. This common representation increases the likelihood that observing an action will trigger an imitative response (Chartrand & Bargh, 1999; Chartrand et al., 2005; Dijksterhuis & Bargh, 2001; Dijksterhuis et al., 2005). The idea that observing an action leads to the activation of the corresponding motor plan in the observer has been confirmed by many empirical findings over the past two decades, including behavioral studies (e.g., Brass et al., 2001; Brass et al., 2000; Craighero et al., 2002; Kilner et al., 2003), fMRI (e.g., Gazzola & Keysers, 2009; Keysers & Gazzola, 2010), motor TMS (e.g., Catmur et al., 2007; Fadiga et al., 1995), as well as single-cell recordings in monkeys (Di Pellegrino et al., 1992) and humans (Mukamel et al., 2010).

Moderating Influences on Imitation

Motor learning theories, such as the associative sequence learning theory (Brass &

Heyes, 2005; Cook et al., 2014; Heyes, 2010; Ray & Heyes, 2011) and ideomotor theory (Greenwald, 1970; Jeannerod et al., 1995; Prinz, 1990, 1997) explain where the shared representations between observed and executed actions originate from. A key idea of these theories is that perception-action links are learned responses that develop as a result of self-observation and interaction with other, often similar (Efferson et al., 2008), individuals (Brass & Heyes, 2005; Cook et al., 2014; Heyes, 2010; Ray & Heyes, 2011). Thus, a prediction from motor-learning theories is that observed stimuli will activate corresponding motor plans to the extent that they are perceptually similar to stimuli with which observers have learned sensorimotor associations (Press, 2011).

Evidence for this claim comes from a variety of experiments investigating how similarity between actor and observer influences automatic imitation. For example, research has shown that topographical similarity between observed and executed actions increase automatic imitation (e.g., Leighton & Heyes, 2010). That is, automatic imitation is enhanced when observed and executed actions share the same effector (e.g., both actions involve the index finger) and the same movement (e.g., both actions involve lifting movements).

Going one step further, research investigating social moderators of imitative behavior suggests that not only topographical similarity of the action, but also similarity between actor and observer may influence automatic imitation (for a review, see Cracco, Bardi, et al., 2018). For example, researchers found that automatic imitation is increased when observing movements executed by human, as compared with non-human, agents (Bird et al., 2007; Brass et al., 2001; Kilner et al., 2003; Liepelt & Brass, 2010; Longo & Bertenthal, 2009; Press et al., 2005; Press et al., 2006, 2007). Similarly, research found reduced automatic imitation effects when the model's movements followed a non-biological, rather than a biological, motion profile (Kilner et al., 2007; Stanley et al.,

2007). Other research demonstrated that movements observed from a first-person perspective, as compared with a third-person perspective, leads to stronger automatic imitation effects (Bortoletto et al., 2013; Genschow et al., 2013; Vogt et al., 2003). Finally, some research suggests that imitation decreases when individuals are faced with out-group, as compared with in-group members (Genschow & Schindler, 2016; Gleibs et al., 2016; see also Hasler et al., 2017).

Although a recent meta-analysis supports the idea that similarity between actor and imitator increases automatic imitation (Cracco, Bardi, et al., 2018), it is important to note that several studies could not successfully replicate the effect of similarity on automatic imitation. For example, not all studies show a clear-cut reduction of automatic imitation when interacting with non-human, as compared with human, agents (Cracco et al., 2015; Jansson et al., 2007; Kilner et al., 2007; Klapper et al., 2014; Press et al., 2007). Other research could not find support for the idea that out-group membership decreases automatic imitation (De Souter et al., 2021; Genschow et al., in press; Rauchbauer et al., 2016)—some even found the opposite effect meaning that out-group membership increased automatic imitation (Rauchbauer et al., 2015).

Present Research

Taken together, although motor learning theories predict that similarity between actor and observer increases automatic imitation, the empirical evidence for this idea is less clear. A reason for this might be that the presented stimuli did not only differ with respect to similarity between actor and observer, but also with respect to other features (e.g., salience of an action) that may either operate in the same or opposite direction of the assumed similarity effect. Thus, to directly test the idea that similarity between actor and observer increases automatic imitation, one would need to implement a research design in which similarity between actor and imitator is manipulated while holding all

other factors constant. In the present research, we applied such a design by measuring automatic imitation while participants merely focused on similarities or differences between themselves and the other person—a method typically used in research on the Selective Accessibility Model (SAM; Mussweiler, 2003).

According to the SAM, people spontaneously and automatically assess their similarity with their interaction partners. In line with basic assumptions underlying the SAM, we predicted that letting participants merely focus on similarities, as compared with differences, increases perceived similarity between themselves and the other person. Furthermore, in line with the idea that similarity between actor and observer increases imitation, we predicted that focusing on similarities, as compared with differences, increases automatic imitation. To test our predictions, we conducted four experiments. In Experiment 1, we tested the basic prediction that merely focusing on similarities, as compared with differences, increases perceived similarity. In Experiments 2 to 4, we tested the hypothesis that a focus on similarities, as compared with a focus on differences, increases automatic imitation as measured with the imitation-inhibition task (Brass et al., 2001; Brass et al., 2000)—the standard paradigm in the research of automatic imitation. In Experiment 2, participants focused either on similarities or differences between themselves and the other person. In Experiment 3 and 4, we added a neutral condition to the design to exploratorily investigate whether the predicted difference between the similarity and difference focus condition is due to an increase in the similarity focus condition, a decrease in the difference focus condition, or both. All data and stimulus materials are openly accessible at the Open Science Framework (OSF; <https://osf.io/rqyne/>).

Experiment 1

We predicted that focusing on similarities, as compared with differences, increases perceived similarity between actor and observer, which in turn should increase automatic imitation. The purpose of Experiment 1 was to investigate whether the manipulation at hand creates the effect it purports. That is, we tested whether merely focusing on similarities between oneself and others actually increases perceived similarity.

Method

Participants and Design. We applied a between-subjects design. That is, dependent on condition, participants either focused on similarities, differences, or neutral aspects between themselves and another person. We were mostly interested in the difference between the similarity and difference condition and aimed to detect a medium-sized effect of $d = 0.5$. A power calculation with G*Power 3.1 (Faul et al., 2007) indicated that the sample size needed to detect such an effect in an independent samples t -test (two-tailed) with a power of $1 - \beta = .80$ and an alpha error probability of $\alpha = .05$ is $N = 64$ participants per condition. We rounded this estimation up to $N = 70$ participants per condition and consequently recruited 210 participants (118 female; 92 male) via Amazon's Mechanical Turk. Participants' age ranged from 20 to 70 ($M = 38.38$; $SD = 11.52$).

Procedure. After being welcomed, participants were presented with the base hand picture that is typically used in the imitation-inhibition task (Brass et al., 2001; Brass et al., 2000). That is, we presented participants with a picture of a mirrored left hand in resting position in front of a blue background. In the similarity focus condition, we instructed participants to focus on similarities between their own hand and the displayed hand. In the difference focus condition, we asked participants to focus on differences

between their own hand and the displayed hand. In the neutral condition, we asked participants to merely focus on the displayed hand. Afterwards, in each condition, we asked participants to list up to three aspects on which they had focused on.

Then, we presented participants again with the hand and asked them to indicate on an 8-point rating scale (1 = *very different*; 8 = *very similar*) how similar/different they perceived the displayed hand in comparison to their own hand.

At the end, participants indicated basic demographic data, were thanked, and dismissed.

Results

To test the main prediction that a focus on similarities, as compared with a focus on differences, increases perceived similarity, we conducted a *t*-tests for independent samples. The results indicate that participants perceived the depicted hand more similar to themselves when focusing on similarities ($M = 5.86$; $SD = 1.61$) as compared with focusing on differences ($M = 4.12$; $SD = 1.85$), $t(137) = 5.92$, $p < .001$, $d = 1.00$, 95% CI [1.16, 2.32].

In further exploratory analyses we tested whether this difference was due to an increase in perceived similarity in the similarity focus condition, a decrease in difference focus condition, or both by comparing the similarity and the difference focus conditions with the neutral focus condition. The results indicate that participants perceived the hand more similar when focusing on neutral aspects ($M = 5.27$; $SD = 1.93$) as compared with focusing on differences ($M = 4.12$; $SD = 1.85$), $t(138) = 3.60$, $p < .001$, $d = .61$, 95% CI [0.52, 1.79]. The difference between focusing on similarities and focusing on neutral aspects fell short of the conventional level of significance, $t(139) = 1.97$, $p = .051$, $d = .33$, 95% CI [-0.003, 1.18].

Discussion

Experiment 1 demonstrates the effectiveness of our manipulation: When participants merely focused on similarities, as compared with differences, between their own hand and another person's hand, they perceived the other hand as more similar to their own hand. Yet, an open question is whether merely focusing on similarities also increases automatic imitation. Experiment 2 to 4 aimed at investigating this question.

Experiment 2

In Experiments 2 to 4 we applied the imitation-inhibition task (Brass et al., 2001; Brass et al., 2000) to measure automatic imitation. In all experiments, we excluded trials and participants based on the same predefined exclusion criteria. In particular, in line with previous research (e.g., Catmur & Heyes, 2011; Cracco et al., 2015), we discarded trials in which participants responded very fast (< 200 ms) and very slow (> 1000 ms). Moreover, we removed participants who made errors in more than 30% of all trials, because these participants did not understand the task.

Method

Participants and Design. Experiment 2 was designed as an initial pilot study to test whether focusing on similarities, as compared with differences, increases automatic imitation. To test this prediction, we implemented a within-subjects design. Twenty-seven students (21 women, 6 men) from Ghent University (Belgium) participated in return for partial course credit. This gave us 80% power to detect an effect size of $d_z = 0.57$ with an alpha error probability of $\alpha = .05$ (two-tailed). This effect size roughly corresponds to a recent meta-analysis on the influence of social moderators on automatic imitation (Genschow, Schuler, et al., 2019), which yielded an effect size of $d_z = 0.58$. Participants' age ranged from 18 to 25 ($M = 18.88$; $SD = 1.56$). Twenty-three participants were right-

handed and four participants were left-handed. None of the participants committed errors in more than 30% of the trials. Thus, we did not exclude any participant.

Procedure

After being welcomed, participants were seated in separate cubicles. Each cubicle consisted of an Asus Eee PC 1215N laptop with an external 17-inch Dell monitor and an AZERTY mac keyboard. Participants sat at a distance of approximately 35 cm to the monitor. After being seated, participants signed a written informed consent, and then ran through the imitation-inhibition task (Brass et al., 2001; Brass et al., 2000).

We programmed the imitation-inhibition task (Brass et al., 2001; Brass et al., 2000) with E-Prime software (Schneider et al., 2002). First, participants learned the task in eight exercise trials. In the beginning of each trial, participants pressed and held down the 'G' and 'H' keys with their right index and middle fingers. In the exercise block, pressing the 'G' and 'H' keys was followed by a fixation cross for 1500 ms. Afterwards, a picture of a mirrored left hand in resting position appeared for 500 ms on the screen. This picture was followed by a second picture that was presented until participants gave a response. Depending on condition, the picture depicted a finger lifting movement of either the index or the middle finger. At the same time either the number '1' or '2' was displayed between the model's middle and index finger. Figure 1 illustrates the different trials. Participants were instructed to lift their index finger as fast as possible in response to the number '1' and to lift their middle finger as fast as possible in response to the number '2'. Participants learned the task in eight exercise trials and received accuracy feedback after each trial.

After the exercise block, participants completed two different experimental blocks (without accuracy feedback) with 100 trials each. In one block, we instructed participants to focus on *similarities* between their own hand and the other person's hand. In the other

block, we instructed participants to focus on *differences* between their own hand and the other person's hand. To strengthen this manipulation, we reminded participants of their focus at the beginning of each trial. That is, instead of a fixation cross, we displayed either the sentence "Focus on similarities" or the sentence "Focus on differences" for 1500 ms. To counteract possible spill-over effects, participants could take a short break between the two experimental blocks.

To prepare data for analysis, we excluded excessively fast and slow trials (cf. Catmur & Heyes, 2011; Cracco et al., 2015)—that is, we discarded trials with a reaction time (RT) faster than 200 ms (0.04%) and trials with a RT slower than 1000 ms (5.70%). For the RT analyses, erroneous trials (2.8%) were excluded as well.

At the end of the experiment, participants indicated basic demographics, were debriefed, and dismissed.

Figure 1

Overview of Incongruent and Congruent Trials in the Imitation-Inhibition Task

Results

Latencies. Mean response latencies are depicted in Table 1. In a first analysis, we tested for the presence of the automatic imitation effect. Participants responded faster on

congruent trials ($M = 487.11$ ms; $SD = 92.82$) than on incongruent trials ($M = 573.68$ ms; $SD = 127.10$), $t(26) = 8.72$, $p < .001$, 95% CI [66.17, 106.98], $dz = 1.70$.

To test our hypothesis that focusing on similarities, as compared to differences, increases automatic imitation, we first computed the congruency effect by subtracting mean reaction times in congruent trials from mean reaction times in incongruent trials and then ran a t -test for dependent samples. The results indicated a larger congruency effect in the block in which participants focused on similarities ($M = 105.52$; $SD = 75.20$) than in the block in which participants focused on differences ($M = 67.62$; $SD = 43.45$), $t(26) = 2.96$, $p = .007$, 95% CI [11.54, 64.27], $dz = 0.57^1$.

Figure 2

Congruency Effects in Experiment 2

Note. Error bars represent the standard error of the mean.

Error Rates. In a second series of analyses, we conducted the same analyses for error rates that we had run for reaction times. Participants made fewer errors on congruent trials ($M = 0.34$ %; $SD = 0.49$) as compared to incongruent trials ($M = 1.90$; $SD = 1.79$), $t(26) = 5.32$, $p < .001$, 95% CI [0.95, 2.15], $dz = 1.02$. However, whether

participants focused on similarities or differences did not influence the congruency effect, $t(26) = 1.24, p = .23$.

Table 1

Mean Response Latencies in Experiments 2 to 4

	RT Congruent Trials (<i>M</i> ; <i>SD</i>) in ms			Incongruent Trials (<i>M</i> ; <i>SD</i>) in ms		
	SF	DF	NF	SF	DF	NF
Exp. 2	485.28 (94.20)	488.94 (98.06)		590.81 (146.11)	556.56 (119.34)	
Exp. 3	453.71 (69.48)	460.43 (72.23)	455.51 (72.53)	549.68 (86.52)	544.90 (83.97)	549.09 (79.19)
Exp. 4	454.61 (68.15)	465.06 (75.32)	466.05 (74.78)	548.15 (79.26)	547.58 (84.55)	555.64 (91.97)

Note. RT (Response Time); SF (Similarity Focus); DF (Difference Focus); NF (Neutral Focus)

Experiment 3

Experiment 2 provides initial support for our hypothesis that a focus on similarities, as compared to differences, increases automatic imitation. Yet an open question is whether this effect is due to a focus on similarities, a focus on differences, or both. Thus, to explore the direction of the effect, in Experiment 3, we added a neutral condition to the design, in which participants focused neither on similarities nor on differences. Moreover, to get a better estimate of the basic effect, we increased the statistical power of the experiment by collecting data from a larger sample.

Method

Participants. We assumed that the difference between the neutral focus condition and the two experimental conditions (i.e., similarity focus and difference focus) would be smaller than the difference between the two experimental conditions. Therefore, we increased the sample size to detect smaller effects. More specifically, we aimed at detecting an effect size of at least $d_z = 0.3$, which corresponds to a small to medium sized

effect (Cohen, 1969). A power calculation with G*Power 3.1 (Faul et al., 2007) indicated that the sample size needed to detect such an effect size in a dependent samples *t*-test (two-tailed) with a power of $1 - \beta = .80$ and an alpha error probability of $\alpha = .05$ is $N = 90$ participants. To compensate for possible dropouts, we recruited 94 participants in return for partial course credit. We discarded seven participants: Six participants were excluded because they failed to give a meaningful answer to the questions on what they had focused during the imitation-inhibition task. One additional participant was excluded because of a technical problem (i.e., reaction times were not recorded in each condition). The final sample consisted of 87 students (62 women, 16 men, 9 not reported) from Ghent University (Belgium). Participants' age ranged from 17 to 48 ($M = 19.40$; $SD = 3.83$). Sixty-nine participants were right-handed, nine participants were left-handed, and nine participants did not report handedness. None of the participants committed errors in more than 30% of the trials.

Procedure. The procedure of Experiment 3 was similar to the one of Experiment 2 with three exceptions. First, in addition to the similarity focus condition and the difference focus condition, we included a neutral condition into the design. In this condition, we instructed participants to merely focus on the other person's hand without mentioning similarities or differences. Second, we changed the amount of trials. In total, the experiment consisted of 240 experimental trials: 80 trials in the similarity focus block, 80 trials in the difference focus block, and 80 trials in the neutral focus block. The order of the three blocks was counterbalanced across participants. Third, to strengthen the manipulation, participants had to list after every 20 trials (except at the end of each block) on which features of the other person's hand they had focused in the last couple of trials.

Data preparation for analysis corresponded to Experiment 2 and previous experiments reported in the literature (cf. Catmur & Heyes, 2011; Cracco et al., 2015).

That is, we discarded trials with a reaction time (RT) faster than 200 ms (0.02%) and trials with a RT slower than 1000 ms (3.80%). For the RT analyses, erroneous trials (2.4%) were excluded as well.

Results

Latencies. Mean response latencies are depicted in Table 1. In a first analysis, we tested for the presence of the automatic imitation effect. As expected, participants responded faster on congruent trials ($M = 456.55$ ms; $SD = 65.69$) than on incongruent trials ($M = 547.89$ ms; $SD = 75.75$), $t(86) = 23.98$, $p < .001$, 95% CI [83.77, 98.91], $d_z = 2.54$.

To test our main hypothesis that focusing on similarities as compared with differences increases automatic imitation, we first computed the congruency effect for each focus condition (i.e., difference focus, similarity focus) by subtracting mean reaction times in congruent trials from mean reaction times in incongruent trials. Afterwards, we ran a t -test for dependent samples. As in Experiment 1, the analysis yielded a larger congruency effect in the similarity focus condition ($M = 95.96$; $SD = 44.26$) than in the difference focus condition ($M = 84.48$; $SD = 46.32$), $t(86) = 2.34$, $p = .021$, $d_z = 0.25$, 95% CI [1.74, 21.23].

Exploratory Analyses. In additional exploratory analyses, we investigated whether the difference between the similarity and difference focus condition is due to larger congruency effects in the similarity focus condition, smaller congruency effects in the difference focus condition, or both. To this end, we conducted two t -tests for dependent samples. The results indicate somewhat smaller congruency effects in the difference focus condition ($M = 84.48$; $SD = 46.32$) than in the neutral focus condition ($M = 93.58$; $SD = 43.52$), although this effect did not exceed the conventional level of

significance, $t(86) = 1.75, p = .083$. The difference between the similarity focus condition and the neutral condition was not significant, $t(86) = 0.48, p = .636$.

Figure 3

Congruency Effects in Experiment 3

Note. Error bars represent the standard error of the mean.

Error Rates. In a final series of analyses, we ran the same statistical tests for error rates as we ran for latencies. In line with past research and Experiment 1 participants made fewer errors on congruent trials ($M = 0.28\%$; $SD = 0.44$) than on incongruent trials ($M = 2.12\%$; $SD = 1.48$), $t(86) = 12.31, p < .001$, 95% CI [1.54, 2.14], $d_z = 1.32$. Similar to Experiment 2, the difference between focusing on similarities ($M = 1.92\%$; $SD = 1.86$) and focusing on differences ($M = 1.69\%$; $SD = 1.54$) was not significant, $t(86) = 1.16, p = .248$. Also, the difference between the neutral focus condition ($M = 1.90\%$; $SD = 2.11$) and the similarity focus condition ($M = 1.92\%$; $SD = 1.86$), $t(86) = 0.07, p = .941$, as well as the difference between the neutral focus condition and the difference focus condition, $t(86) = 0.87, p = .388$, was not significant.

Discussion

Experiment 3 modified the procedure of Experiment 2 in several ways. First, we added to the similarity and difference focus conditions a neutral condition in which participants did not focus on any similarities or differences. Second, to strengthen the manipulation, every 20 trials, participants had to write down on what aspects they were focusing on.

The results replicated those obtained in Experiment 2 and, thus, support our main hypothesis that a focus on similarity increases automatic imitation, as compared with a focus on differences. Additional exploratory analyses indicate that the neutral focus condition lies somewhere in between the similarity focus condition and the difference focus condition. However, the statistical analyses do not clearly indicate to which degree the neutral focus condition lies on the same level as the similarity focus condition or the difference focus condition. A reason for the lack of evidence is that Experiment 3 might have been underpowered. Thus, to repeat Experiment 3 with a larger sample, we conducted Experiment 4.

Experiment 4

Method

Participants. To replicate Experiment 3, we increased the sample size to 140 participants, allowing us to detect an effect size of at least $d_z = 0.24$ with an alpha error probability of $\alpha = .05$ (two-tailed) and 80% power in a within-subjects design. Based on the same exclusion criteria used in Experiments 2 and 3, we discarded five participants: Three participants were excluded because they failed to give a meaningful answer to the questions on what they had focused on during the imitation-inhibition task. One additional participant was excluded because of a technical problem (i.e., we were not able to collect reaction times in each condition). Finally, one participant was excluded because

this person committed errors in more than 30 percent of all trials. The final sample consisted of 135 students (93 women, 36 men, 6 not reported) from Ghent University (Belgium). Participants' age ranged from 16 to 45 ($M = 20.08$; $SD = 11.00$); 114 were right-handed, 15 were left-handed, and six did not report handedness.

Procedure. The procedure was the exact same as the one of Experiment 3. Data preparation for analysis corresponded to Experiments 2 and 3. That is, we discarded trials with a reaction time (RT) faster than 200 ms (0.4%) and trials with a RT slower than 1000 ms (3.10%). For the RT analyses, erroneous trials (3.5%) were excluded as well.

Results

Latencies. Mean response latencies are depicted in Table 1. First, we tested for the presence of the automatic imitation effect. Participants responded faster on congruent trials ($M = 461.90$ ms; $SD = 65.37$) than on incongruent trials ($M = 550.46$ ms; $SD = 75.49$), $t(134) = 28.96$, $p < .001$, 95% CI [82.50, 94.60], $dz = 2.49$.

Second, to test the main hypothesis that a focus on similarities, as compared with a focus on differences, increases automatic imitation, we computed for each experimental condition (i.e., difference focus, similarity focus) the congruency effect by subtracting mean reaction times in congruent trials from mean reaction times in incongruent trials. Afterwards, we ran a t -test for dependent samples. In line with our prediction and the results obtained in Experiment 2 and 3, participants' congruency effect was larger when they focused on similarities ($M = 93.54$; $SD = 43.02$) than when they focused on differences ($M = 82.52$; $SD = 42.44$), $t(134) = 2.60$, $p = .010$, 95% CI [2.64, 19.40], $dz = 0.22^3$.

Exploratory Analyses. In further exploratory analyses we tested whether the difference between the similarity and the difference focus condition is due to larger congruency effects in the similarity focus condition, smaller congruency effects in the

difference focus condition, or both. To this end, we conducted two t -tests for dependent samples. The results indicate that neither the difference focus condition and the neutral focus condition ($M = 89.59$; $SD = 57.73$), $t(134) = 1.38$, $p = .171$, nor the similarity focus condition and the neutral condition, $t(134) = 0.77$, $p = .446$, differed significantly from each other.

Figure 4

Congruency Effects in Experiment 4

Note. Error bars represent the standard error of the mean.

Error Rates. In a final series of analyses, we ran the same statistical tests for error rates as we ran for latencies. Participants made fewer errors on congruent trials ($M = 0.76\%$; $SD = 1.06$) than on incongruent trials ($M = 5.14\%$; $SD = 3.97$), $t(134) = 13.70$, $p < .001$, 95% CI [3.75, 5.01], $d_z = 1.18$. Similar to our previous experiments, the difference between focusing on similarities ($M = 4.04\%$; $SD = 3.92$) and focusing on differences ($M = 4.37\%$; $SD = 4.10$) was not significant, $t(134) = 0.97$, $p = .334$. Also, the difference between the neutral focus condition ($M = 4.73\%$; $SD = 5.84$) and the similarity focus condition ($M = 4.04\%$; $SD = 3.92$), $t(134) = 1.42$, $p = .158$, as

well as the difference between the neutral focus condition and the difference focus condition, $t(134) = 0.78, p = .438$, was not significant.

Mini Meta-Analyses Across All Experiments

In Experiments 2 to 4, we found consistent effects in line with our main prediction that focusing on similarities, as compared with differences, produces larger automatic imitation effects. Moreover, exploratory analyses in Experiment 3 and 4 indicated a trend suggesting that individuals imitated most when they focused on similarities, less when they focused on neutral aspects, and the fewest when they focused on differences. To get further insights into the exact differences between the focus conditions, we ran three mini meta-analyses.

First, we computed for each experiment the effect sizes for the difference between the (1) similarity focus condition and the difference focus condition (i.e., Experiments 2-4), (2) the similarity focus condition and the neutral focus condition (i.e., Experiments 3-4), and (3) the neutral focus condition and the difference focus condition (i.e., Experiments 3-4). Afterwards, we ran fixed effects meta-analyses with *R* (R Core Team, 2020; version 4.0.3) using the metafor package (Viechtbauer, 2010).

The analyses indicated that participants imitated more strongly when focusing on similarities than when focusing on differences, $d = 0.27, z = 4.13, p < .001$. There was no statistical difference between the similarity focus condition and the neutral condition, $d = 0.06, z = 0.90, p = .371$. However, participants imitated less strongly when focusing on differences than when focusing on neutral aspects, $d = 0.15, z = 2.16, p = .031$. This overall pattern indicates that it is the dissimilarity focus that decreases automatic imitation, but not the similarity focus that increases automatic imitation.

General Discussion

In the present research, we tested whether merely focusing on similarities, as compared with differences, increases automatic imitation. Experiment 1 demonstrates that focusing on similarities, as compared with differences, increases perceived similarity to another person. In three further experiments we found consistent evidence that focusing on similarities, as compared with differences, caused individuals to imitate others more strongly. Moreover, a mini meta-analysis on the combined data suggests that compared with a neutral focus condition, focusing on dissimilarities decreases automatic imitation, but focusing on similarities does not increase automatic imitation. These results have important implications for existing theories on imitation.

First, our experiments support the purported role of similarity in motor learning theories such as the associative sequence learning theory (Brass & Heyes, 2005; Cook et al., 2014; Heyes, 2010; Ray & Heyes, 2011) and the ideomotor theory (Greenwald, 1970; Jeannerod et al., 1995; Prinz, 1990, 1997). These theories assume that perception-action links are learned responses that develop as a result of self-observation. Based on this idea, observed stimuli should activate corresponding motor plans to the extent that they are perceptually similar to the stimuli with which observers have learned sensorimotor associations (Press, 2011). In other words, perception-action links and imitative tendencies hinge on the similarity between actor and observer. Our findings that merely focusing on similarities, as compared with differences, increases automatic imitation supports this idea.

At the same time, our results extend motor learning theories by showing that it is not similarity that increases automatic imitation, but rather differences between interaction partners that decrease imitation. In other words, our data suggest that when imitating others, focusing on similarities is the default mode. This supports the idea of

imitation as an automatic response in the sense that individuals automatically imitate others as long as they are more or less similar to themselves. Only if others become different, individuals' automatic tendency to imitate others gets reduced. This implication is in line with research on the Selective Accessibility Model (SAM; Mussweiler, 2003) according to which individuals assimilate to others when focusing on similarities and contrast themselves away from others when focusing on differences. Similar to our findings, research on the SAM has shown that focusing on similarities is the default process in social comparison (Corcoran et al., 2011; Mussweiler, 2003). That is, inducing a focus on differences elicits stronger contrastive effects, whereas inducing a focus on similarities is less likely to increase the default assimilative effects.

In addition to motor learning theories, our results also relate to other theories explaining the social modulation of automatic imitation. Motivational theories of imitation (Chartrand & Dalton, 2009; Wang & Hamilton, 2012) postulate that individuals imitate others either consciously or unconsciously to gain social benefits by creating a social bond and feelings of affiliation. While motivational theories can explain *why* social modulation takes place, these theories remain silent about the underlying mechanisms that drive such modulated effects and thereby leave open *how* social modulation takes place. Our research, together with motor learning theories, extends motivational theories by offering a potential mechanism underlying social modulation of automatic imitation. That is, we suggest that similarities, as compared with differences, between observed and executed actions elicit stronger corresponding motor plans in the observer, which subsequently increases automatic imitation.

Although different theories allow explaining social modulations of imitative behavior, it is important to note that some of the experiments finding support for social modulation could not be replicated. For example, some studies could not detect a clear-

cut reduction of automatic imitation when interacting with non-human, as compared with human, agents (Cracco et al., 2015; Jansson et al., 2007; Kilner et al., 2007; Klapper et al., 2014; Press et al., 2007). Other research indicates that out-group members, which are typically less similar than in-group members, do not decrease automatic imitation either (De Souter et al., 2021; Genschow et al., in press; Rauchbauer et al., 2015; Rauchbauer et al., 2016). One reason for the difficulty to find such social modulation is that the presented stimuli typically do not only differ with respect to similarity between actor and observer, but also with respect to other features. Our research indicates that when similarity between actor and imitator is manipulated while holding other factors constant, social modulation can be detected. In the same time, we need to acknowledge that our effects are with an overall effect size of $d = 0.27$ rather small. Especially the meta-analytical effect between the difference focus condition and the neutral focus condition was with an effect size of $d = 0.15$ very small and just significant. Thus, one should interpret this result with caution and replicate it in future research. In the same time, the small effect sizes illustrate another reason why it might be difficult to replicate some of the experiments investigating social modulations: Social moderators most likely have rather small effects on automatic imitation and detecting them calls for large sample sizes.

While our research shows that a focus on similarities, as compared with differences, increases the automatic tendency to imitate others, an open question is whether a similar process is taking place in reversed order as well. That is, the question arises whether being imitated by another person would lead to the perception of similarity. If this is the case, perceived similarity may explain a variety of different findings, such as the effects of being imitated on liking (Chartrand & Bargh, 1999; Sparenberg et al., 2012), feelings of closeness (van Baaren, Holland, et al., 2004), and

affiliation (Lakin & Chartrand, 2003). Future research could investigate this assumption in more detail.

Going one step further, we would like to argue that the similarity assumption is not limited to automatic imitation. It might well be that perceived similarity could explain modulations of different kinds of social interactions. For example, past research has shown that joint action effects are moderated by similar factors as those moderating automatic imitation. Such research indicates that joint action effects are more strongly pronounced when interaction partners are in a romantic relationship (Giesen et al., 2018; Quintard et al., 2018), when individuals interact with in-group as compared to out-group members (Iani et al., 2011; Müller et al., 2011), or when they interact with human as compared to non-human agents (Tsai & Brass, 2007). Future research may aim at testing whether a focus on similarities (versus differences) also accounts for moderating influences in joint-action paradigms and other social cognitive facets such as Theory of Mind, or perspective taking—for instance.

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Footnotes

¹ When repeating this analysis with right-handed participants only, the effect remained significant, $t(22) = 2.77$, $p = .011$, 95% CI [10.39, 72.45], $dz = 0.58$.

² When repeating this analysis with right-handed participants only, the effect remained significant, $t(68) = 2.21$, $p = .030$, 95% CI [1.18, 22.85], $dz = 0.27$.

³ When repeating this analysis with right-handed participants only, the effect remained significant, $t(113) = 2.53$, $p = .013$, 95% CI [2.61, 21.36], $dz = 0.24$.

⁴ In addition to the experiments reported here, we replicated this basic finding in an online experiment. However, as we got the feedback from many participants that they did not follow the instructions to focus on similarities and differences, we decided to not include the experiment into the manuscript. It is important to note, however, that even when including this experiment into the meta-analysis, the results remain the same, $d = 0.16$, $z = 3.35$, $p < .001$.