Psychological distance modulates goal-based versus movement-based imitation

Oliver Genschow* (University of Cologne)

Jochim Hansen* (University of Salzburg)

Michaela Wänke (University of Mannheim)

Yaacov Trope (New York University)

Authors' Note

*Oliver Genschow and Jochim Hansen contributed equally to this paper and appear in alphabetical order as first authors.

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Correspondence concerning this article should be addressed either to Oliver Genschow, University of Cologne, Social Cognition Center Cologne, Richard-Strauss Str. 2, 50931 Köln, Germany, oliver.genschow@uni-koeln.de; or to Jochim Hansen, University of Salzburg, Department of Psychology, Hellbrunnerstr. 34, 5020 Salzburg, Austria, jochim.hansen@sbg.ac.at

Abstract

In past research on imitation, some findings suggest that imitation is goal based, whereas other findings suggest that imitation can also be based on a direct mapping of a model's movements without necessarily adopting the model's goal. We argue that the two forms of imitation are flexibly deployed in accordance with the psychological distance from the model. We specifically hypothesize that individuals are relatively more likely to imitate the model's goals when s/he is distant but relatively more likely to imitate the model's specific movements when s/he is proximal. This hypothesis was tested in four experiments using different imitation paradigms and different distance manipulations. Experiment 1 served as a pilot study and demonstrated that temporal distance (vs. proximity) increased imitation of a goal relative to the imitation of a movement. Experiments 2 and 3 measured goal-based and movement-based imitation independently of each other and found that spatial distance (vs. proximity) decreased the rate of goal errors (indicating more goal imitation) compared to movement errors. Experiment 4 demonstrated that psychological distance operates most likely at the input—that is, perceptual—level. The findings are discussed in relation to construal level theory and extant theories of imitation.

Keywords: imitation; psychological distance; construal level; goal; movement

Public Significance Statement

In past research on imitation, some findings suggest that imitation is goal based, whereas other findings suggest that imitation can also be based on a direct mapping of a model's movements without necessarily adopting the model's goal. In four experiments, we demonstrate that the two forms of imitation are flexibly deployed in accordance with the psychological distance from the model. We specifically show that individuals are relatively more likely to imitate the model's goals when s/he is distant but relatively more likely to imitate the model's specific movements when s/he is proximal.

Imitation is a ubiquitous social phenomenon, and individuals imitate a wide range of different behaviors (for a distinction between different forms of imitation, see Genschow et al., 2017), including facial expressions (Dimberg, 1982), emotions (Hess & Fischer, 2016), postures (LaFrance, 1982), gestures (Bernieri, 1988; Cracco, Genschow, Radkova, & Brass, 2018; Wessler & Hansen, 2017), or simple movements (Brass, Bekkering, Wohlschläger, & Prinz, 2000; Cracco, Bardi, et al., 2018; Genschow, Florack, & Wänke, 2013). Infants and toddlers imitate what adults are doing, which helps them to learn new skills (e.g., Bandura, 1986). Moreover, it has been argued that imitation serves a social function (Chartrand & Dalton, 2009; Wang & Hamilton, 2012) in the sense that it fosters a prosocial orientation (Kavanagh & Winkielman, 2016; Lakin, Chartrand, & Arkin, 2008; Stel, Van Baaren, & Vonk, 2008; van Baaren, Horgan, Chartrand, & Dijkmans, 2004), empathy (Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; Iacoboni, 2009), liking for each other (Sparenberg, Topolinski, Springer, & Prinz, 2012) and perspective taking (Lamm, Batson, & Decety, 2007; Lamm, Porges, Cacioppo, & Decety, 2008)—to name just a few examples. In all of these domains, imitation may take place at multiple levels ranging from adopting the relatively high level goals of an observed behavior (Byrne, 1993; Byrne & Byrne, 1991; Byrne, 1999; Byrne, 2003; Meltzoff & Moore, 1997; Perra & Gattis, 2008; Wohlschläger & Bekkering, 2002) to mirroring relatively low level performance characteristics of the observed behavior, such as other individuals' movements (Brass et al., 2000; Genschow & Florack, 2014; Genschow et al., 2013; Genschow & Schindler, 2016). However, past research has focused on either goal-based or on movement-based imitation, without considering how the two forms of imitation are related and modulated by the context in which imitation occurs. In this paper, we investigate both goal-based imitation and movement-based imitation and demonstrate how the two forms of imitation are attuned to the context in which they occur.

In particular, we investigate the effect of psychological distance on the level of imitation. A certain distance between the imitator and the imitated person (i.e., the model) is inherent to all situations that involve imitation: The model can be spatially near or distant (e.g., when one is observing another person face to face vs. in a video) or temporally near or distant (e.g., when observing a person who appears in a recent vs. an old movie clip). Moreover, the model can be socially distant or near, for example when s/he is an out-group member or an in-group member, respectively. Although the psychological distance between the observer and model is a universal aspect of imitation, the degree to which it actually affects different levels of imitation has not yet been studied. In the present research, we investigate for the first time how psychological distance influences goal-based versus movement-based imitation. Building on construal level theory (Trope & Liberman, 2003, 2010), we hypothesize that psychological distance leads an observer to focus on the model's goal more than on the model's specific movements. Consequently, the model's goal should be more salient than the model's specific movements when the model is distant, but the model's movements should be more salient than the model's goal when the model is close. As a result of this difference in salient information, observers should show relatively more goal-based and relatively less movement-based imitation with increasing psychological distance from the model.

Goal-Based and Movement-Based Imitation

Past research has found evidence for both goal-based and movement-based imitation. In the former form of imitation, observers extract the high-level goal of the observed behavior and use this goal as a guide for their own course of action (Byrne, 1993; Byrne & Byrne, 1991; Byrne, 1999; Byrne, 2003; Meltzoff & Moore, 1997; Perra & Gattis, 2008; Wohlschläger & Bekkering, 2002). The adoption of a goal activates the most relevant motor programs for achieving that goal. Critically, the resulting action itself does not necessarily have to match the observed one. Observing another person lifting weights, for instance, may activate the goal to exercise, but one might choose another form of exercise (e.g., spinning on an ergometer). Indeed, research conducted in the framework of the theory of goal-directed action (GOADI; Bekkering, Wohlschlager, & Gattis, 2000; Gleissner, Meltzoff, & Bekkering, 2000; Wohlschläger, Gattis, & Bekkering, 2003) demonstrates that when asked to imitate a model, children and adults tend to reproduce the goal of the observed action rather than the model's specific movements. For example, in the so-called pen-and-cups task (Bekkering et al., 2000; Wohlschläger, Gattis, & Bekkering, 2003), three components of an action are manipulated: object selection, effector selection, and grip selection. On each trial, observers see a model moving a pen into one of two colored cups (object), using the right or the left hand (effector) while grasping the pen with the thumb pointing up or down (grip). When asked to imitate this activity, observers typically make fewer cup errors than hand errors and fewer hand errors than grip errors (see also Avikainen, Wohlschläger, Liuhanen, Hänninen, & Hari, 2003; Leighton, Bird, Charman, & Heyes, 2008; Wohlschläger & Bekkering, 2002). Given that the primary goal of each activity is to place the pen into a cup, this cup < hand < grip error pattern has been taken as evidence that observers are generally prepared to imitate goals rather than specific movements. This view has been supported by a number of similar findings (Gattis, Bekkering, & Wohlschläger, 2002; Genschow, Bardi, & Brass, 2018; Genschow & Brass, 2015; Genschow, Klomfar, d'Haene, & Brass, 2018; Gleissner et al., 2000; Head, 2014; Want & Gattis, 2005) and is in line with early (e.g., Powers, 1973) and more recent (e.g., Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005) approaches that view goals as a key driver of behavior.

Besides evidence for goal-based imitation, there is also considerable theoretical and empirical work suggesting that individuals often match their specific movements to the observed movements when they imitate an activity, even without necessarily coactivating a corresponding goal. More than 100 years ago William James claimed that "every representation of a movement awakens in some degree the actual movement which is its object" (James, 1890, p. 1134). In a similar vein, ideomotor theory (Greenwald, 1970; Prinz, 1990, 1997) posits that perceiving a motor action evokes the same representation as the execution of this action and thereby makes the execution of the perceived action more likely. In the last decades, this view has been supported by neuropsychological research, including fMRI studies (e.g., Gazzola & Keysers, 2009; Keysers & Gazzola, 2010), motor TMS studies (e.g., Catmur, Walsh, & Heyes, 2007; Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995), and single-cell recordings in both monkeys (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992) as well as humans (Mukamel, Ekstrom, Kaplan, Iacoboni, & Fried, 2010). In line with these notions, behavioral research has demonstrated that merely observing another person executing a movement activates similar motor programs in the observer, facilitating the execution of that movement (e.g., Brass et al., 2000). For example, in the imitation-inhibition task (for a meta-analysis, see Cracco, Bardi, et al., 2018), participants observe an actor lifting either his index or his middle finger. Participants are asked to respond with either a compatible or an incompatible finger movement in respect to a number displayed on a computer screen. A common finding is that observing compatible movements results in faster movement onsets than observing incompatible movements.

Using a similar task, Leighton and Heyes (2010) demonstrated that when people imitate a goal, they are influenced by concrete, low-level features of an action. In their experiments, participants were required to open or a close either their hand or their mouth in response to letters presented on a screen. Importantly, the same screen showed task-irrelevant action images depicting a hand or mouth opening or closing. The results indicated that participants' behavior (i.e., following the goal of opening or closing hand or mouth in response to the letters) was influenced not only by the compatibility of the action goal (open vs. closed response) but also by the compatibility of the actual body parts shown in the presented images. That is, participants were generally quicker in following the goal when the task-irrelevant image showed the same response as required (open vs. closed response), but this effect was much more pronounced when the actual body part in the picture (hand vs. mouth) matched the body part that participants were required to use for their own action.

Consistent with these findings, research on cross-contextual imitation demonstrated that individuals imitate movements even without sharing a common goal with the model (Genschow & Florack, 2014; Genschow et al., 2013; Genschow & Schindler, 2016). In this research, participants tasted a drink while watching a cross-contextually compatible or incompatible movement. Participants in the compatible movement condition watched a video of an athlete in a gym lifting a barbell from his waist toward his head. Participants in the incompatible movement condition watched the same athlete push the barbell away from his body. In both conditions, the athlete followed a completely different goal (i.e., exercising) from that of participants (i.e., drinking). Nevertheless, watching the lifting movement activated compatible movements in participants (i.e., lifting the cup to mouth), which, in turn, resulted in increased drink intake. In contrast, watching the pushing movement activated a movement incompatible with drinking, which decreased drink intake. Ruling out the alternative explanation of a general approach/avoidance priming, the researchers demonstrated that this effect held when the drinking mode allowed for imitation (i.e., drinking from cups) but not when it did not allow for imitation (i.e., drinking through a drinking tube).

In sum, research on imitation has found evidence for goal-based imitation as well as for goal-independent, movement-based imitation. However, what factors determine the degree to which people engage in goal-based versus movement-based imitation remains an open question. We argue that people can flexibly deploy the two forms of imitation in accordance with the context in which imitation occurs and the characteristics of the model. We specifically hypothesize that psychological distance modulates the degree to which people engage in these two forms of imitation.

Construal Level and Psychological Distance

Any action can be represented at different levels of construal (Vallacher & Wegner, 1987, 1989, 2014; Wegner & Vallacher, 1986). Lower level construals are concrete and contextualized representations that include subordinate and incidental features of action, such as specific movements. Higher level construals are abstract and decontextualized representations that extract the gist from the available information. They emphasize superordinate, core features of actions, such as goals. For example, representing the action of drinking as “quenching thirst” as opposed to “moving a bottle to the lips” omits information about the specific movements involved in the action but communicates its core goal.

The main function of the different levels of construal according to construal level theory, is the contraction and expansion of one’s mental horizons or regulatory scope (Liberman & Trope, 2014; Trope & Liberman, 2010). A low level of construal contracts one’s mental horizons and helps one act in the immediate environment, as it focuses on details of the situation and the specifics of responding to it. A high level of construal, in contrast, expands one’s mental horizons and allows one to represent targets that are removed from the egocentric here-and-now, as it focuses on aspects that are more central and relatively stable across different situations and contexts.

Accordingly, psychological distance—the removal of events from direct experience in terms of time, space, social distance, or hypotheticality—influences how people construe events (Liberman & Trope, 2008; Trope & Liberman, 2003, 2010). As events become removed from the direct experience, information about the event becomes less available or less reliable. Individuals may therefore represent psychologically distant actions relatively more by their abstract goals and psychologically near events relatively more by their concrete movements (Liberman & Trope, 1998). For example, moving to a new apartment sometime in the *distant future* is likely represented in terms of one's overarching goal (e.g., starting a new phase of life), whereas moving to a new apartment *today* is likely represented in terms of specific actions (e.g., lifting boxes). Cybernetic theories of action control likewise argue that goals are translated into subgoals close to the time of implementation approaches (Carver & Scheier, 1981; Vallacher & Wegner, 1987). People may thus flexibly switch between high-level and low-level construal of the same event depending on whether it is framed as psychologically distant or proximal (Trope & Liberman, 2003, 2010).

Importantly, the adaptive utilization of high-level construal for distant actions and of low-level construal for proximal actions may be overgeneralized. The construal of a given action would then be relatively abstract when the action is framed psychologically distant than when it is framed psychologically proximal even when the information about the action is the same in the distal-framing and in the proximal-framing (Fujita, Henderson, Eng, Trope, & Liberman, 2006). Thus, when the same action is framed as distant rather than proximal, people may represent it in terms of high-level goals that carry its relatively invariant essence rather than in terms of concrete, more incidental, and potentially changeable means, even when the available information about the proximal versus distant action is exactly the same (Fujita et al., 2006; Liberman & Trope, 1998).

A considerable amount of research has demonstrated the relationship between psychological distance and level of construal of actions (for a review, see Trope & Liberman, 2010). For instance, in one study conducted by Liberman and Trope (1998), participants were asked to describe various activities. When they imagined performing the activities (e.g., watching television) in the distant future (i.e., in a year), compared to the near future (i.e., tomorrow), participants described the activities abstractly (e.g., being entertained) rather than concretely (e.g., flipping channels). Fujita et al. (2006) found similar effects with a spatial distance manipulation. When participants imagined engaging in activities in a distant location, compared to a near location, they described the activities more abstractly. Additionally, recent research has demonstrated that individuals better learn (and prefer to learn) low-level information from near models and high-level information from distant models (Kalkstein, Kleiman, Wakslak, Liberman, & Trope, 2016). These and other studies suggest that individuals represent actions at a low level when the actions are framed as proximal, and at a high level when they are framed as distant (Liberman & Trope, 2008; Trope & Liberman, 2003, 2010).

Given that psychological distance modulates the construal of actions, we suggest that it should also influence the degree to which people imitate the goals or the movements of observed actions. Since psychological distancing proximity results in a mental representation of the observed action more in terms of goals versus movements, different features of the observed actions are salient depending on distance. Movements should be relatively more salient when actions are proximal actions, whereas goals should be relatively more salient when the actions are distal. The respective salient information, in turn, is likely transferred into one's own action so that when low-level movement representations are made salient, they would be readily transferred into one's own motor actions (Greenwald, 1970; Prinz, 1990, 1997). Likewise, when high-level goals are made salient, they should guide one's actions (Bargh, 1990; Bargh & Ferguson, 2000; Wegner & Bargh, 1998).

We suggest that psychological distance (as compared to psychological proximity) facilitates goal-based versus movement-based imitation. Initial support for this idea has been obtained by studies that used an observational learning paradigm, showing that individuals reproduce near behavior, compared to distant behavior, in a more literal action-by-action manner (Hansen, Alves, & Trope, 2016). In one study, for instance, New York University students were asked to learn a new activity (i.e., creating a dog out of towels) by watching a video of a model performing the activity (Hansen et al., 2016, Exp. 2). Spatial distance from the model was manipulated: Half of the participants were told that the video was made in a spatially proximal location (i.e., New York) whereas the other half of the participants were told that the video was made in a spatially distant location (i.e., Los Angeles). The model in the video performed the activity in a particular way. For instance, she rolled one of the towels first from the right then from the left side, flattened the towel at specific points in the video, and folded the ear of the dog in a certain way. After watching the video, participants tried to recreate the dog on their own. Their behavior was filmed and coded for how closely their movements matched those of the model. The results showed that the model's movements—whether necessary or unnecessary for completing the task—were reproduced more literally when participants believed the model was near (New York) rather than distant (Los Angeles). The perceived difficulty of the task, effort, and motivation were not affected by distance. This finding suggests that when learning a new behavior from a model, the behavior of a model is reproduced more concretely, in terms of specific movements, when the model is believed to be psychologically near rather than distant.

However, while Hansen et al.'s (2016) research shows that psychological distance affects imitation of movements, it has not examined whether psychological distance affects imitation of goals. Moreover, while Hansen et al.'s (2016) research demonstrated that distance affects reproduced behavior when people deliberately learn a novel task, it has not examined whether psychological distance affects unintentional imitation. In the present research, we sought to fill these gaps by examining unintentional forms of imitation and disentangling the effect of psychological distance on goal-based imitation from its effect on movement-based imitation. We thereby address the fundamental question whether the different forms of imitation can be naturally deployed in accordance with the characteristics of the model.

Overview of Research

In four experiments, we tested the hypothesis that psychological distance (vs. proximity) fosters goal-based versus movement-based imitation. Experiment 1 was construed as pilot study and applied a between-subject design in order to explore the basic effect.[1] By taking into account preliminary evidence from this initial experiment, in Experiments 2 and 3, we turned to more powerful within-subject designs and used an adapted, computerized version of the pen-and-cups task to measure goal-based imitation independently of movement-based imitation (cf. Wohlschläger & Bekkering, 2002). In Experiment 4 we tested the degree to which psychological distance operates at the input or the output level of the imitative process. Stimulus material and data of all the Experiments are available at the Open Science Framework (OSF) under the following link: https://osf.io/gc8px/

Experiment 1

In Experiment 1 we contrasted goal-based imitation with movement-based imitation by having participants watch a model pursuing a goal. That is, her goal was to either drink a lot or to drink a little. These goals could be accomplished by two different movements: moving cups to the right side or to the left side. Participants likewise chose how much they would like to drink by placing cups on their right or left side. The degree to which participants imitated the goal was quantified by the chosen amount of cups. Conversely, the degree to which participants imitated the movements was quantified by the amount of right and left movements that matched those of the model. Crucially, the experimental setup was arranged in such a way that participants had to engage in movements opposed to the model's movements when imitating the model's goal.

Likewise, when imitating the model's movements, participants achieved the opposite of the model's goal. This allowed us to disentangle movement-based from goal-based imitation.

Prior to the assessment of imitation, we primed temporal distance by asking participants to write an essay either about their life the next day or about their life in 1 year. The logic behind this manipulation is the following: When participants think about their life in 1 year they mentally distance themselves more strongly from the current experimental situation—and thus from the presented model—than when they think about their life the next day. This difference in self-distancing leads to a higher level of mental construal (as has been shown in previous research that successfully implemented this type of distance manipulation; Rim, Hansen, & Trope, 2013) and should thus increase the accessibility of the model's goal compared to the model's specific movements. This, in turn, should translate into participants' actions. Therefore, we expected that participants writing about their life in 1 year would relatively more imitate the model's goal (vs. her movements) than participants writing about their life the next day.

Method

Participants and design. Due to the pilot-study-character, we did not run a priori power analysis, but collected twenty participants for each cell as a rule of thumb (Simmons, Nelson, & Simonsohn, 2011). Thus, in total eighty undergraduate students (59 female, 21 male) from the University of Mannheim (Germany) participated in the experiment for course credit. Age ranged from 17 to 30 years (M = 21.29 years, SD = 2.46). Participants were randomly assigned to one of four conditions in a 2 × 2 (Drinking Goal [a lot, a little] × Temporal Distance [next day, in 1 year]) between-subjects factorial design. The dependent variable was the number of cups participants selected to drink.

Procedure. After being greeted, participants were seated at a table. Up to three participants were tested simultaneously. Large partition walls were placed between the tables so that participants could not see each other. The experimenter first explained that participants later would have to select some drinks for tasting. Before performing this selection task, participants in the distant condition were asked to write a short essay about their lives in 1 year. Participants in the proximal condition were asked to write an essay about their lives the next day. All participants were instructed to "imagine what you might do, who you might talk to, where you might be, or anything else that comes to mind" and then to write their freely occurring thoughts in the space provided. Participants had 5 min to write their essay.

After the temporal distance manipulation, the imitation task was presented. The experimenter placed nine small plastic cups, each with a capacity of 20 ml, in front of the participants. Before participants entered the lab, the experimenter had already dripped exactly 7 ml of an iced-tea-flavored drink into each cup with a pipette. This procedure ensured that participants could not base their drink selection on the amount of liquid in the cups or on the color of the drinks. In addition to the cups, the experimenter put one paper placemat on the left side of the cups and another paper placement on the right side of the cups. One placemat was labeled in red with the word "away." The other was labeled in green with the word "drink." Then, the experimenter told participants that they should put all the drinks they would like to taste on the placemat that was labeled "drink" and all the drinks they would not like to taste on the placemat that was labeled "away." It was furthermore explained that to clarify the task, participants would first watch a video of another participant who had performed the task previously. The videos of the model were presented with a projector on a wall, which participants watched from a distance of approximately 3.6 m.

Crucially, within the video the goal of the model was manipulated. In one condition the model's goal was to drink a large amount. Hence, the model placed eight cups on the "drink" placemat and one cup on the "away" placemat. In the other condition, the model's goal was to drink a small amount. Therefore, she placed eight cups on the placemat labeled “away” and one cup on the placemat labeled “drink.” To control for the direction of the movements, we counterbalanced whether the “away” or the “drink” placemat was placed on the left or right side of the model. Each video was taken from the first-person perspective of a female model. Video duration was 33 sec.

After the video was shown, participants performed the task themselves while again observing the video in an endless loop. Crucially, the position of the placemats differed for the participants and the model. That is, participants who observed a model with the “drink” placemat on her left side and the “away” placemat on her right side had their own “drink” placemat on the right side and the “away” placemat on the left side, and vice versa (see Figure 1 for an illustration of the task). This setup allowed us to contrast movement-based imitation with goal-based imitation. That is, if participants imitated the model’s goal, they would engage in movements opposite to those of the model. Similarly, if participants imitated the model’s movements, they would accomplish the opposite goal of the model. As soon as participants finished sorting all their drinks, the experimenter counted how many cups were placed on the “drink” placemat. At the end of the experiment, participants provided basic demographic data, were debriefed, and dismissed.

Results

We expected participants primed with temporal distance, as compared to temporal proximity, to relatively more strongly imitate the model’s goals than the model’s movements. That is, compared to the temporal proximity condition, participants in the temporal distant condition would place more cups on the “drink” placemat in the condition where the model’s goal was to drink a large amount, compared to the condition in which the model’s goal was to drink a small amount. Although a Levene’s test indicated that the group variances were homogeneous, $F(3, 76) = 1.357$, $p = .262$, a Kolmogorov–Smirnov test indicated that the number of cup placed on the "drink" placemat was not normally distributed, $p = .021$. Thus, we computed a nonparametric 2 × 2 (Drinking Goal [a lot, a little] × Temporal Distance [next day, in 1 year]) analysis of variance (ANOVA) for general factorial designs using using the rankFD package in the R programming environment (Brunner, Dette, & Munk, 1997; Brunner, Konietschke, Pauly, & Puri, 2017). In line with our hypothesis, this analysis yielded a significant interaction between the model's drinking goal and temporal distance, $F(1, 72.54) = 4.99$, $p = .029$ (see Figure 2). Participants who wrote about their life the next day were more likely to imitate the movement of the model by placing more cups on the same side as the model, resulting in more cups on the "drink" placemat when the model's goal was to drink only little ($Mdn = 5$, 95% CI [4; 6]) than when the model's goal was to drink a lot ($Mdn = 4$, 95% CI [2; 5]), $F(1, 36.76) = 5.52$, $p = .024$. The same nonparametric test for participants who wrote an essay about their life in one year did not reach significance ($Mdn_{\text{Model drinks little}} = 5$, 95% CI [3.5; 5.5] vs. $Mdn_{\text{Model drinks a lot}} = 5$, 95% CI [3; 6]), $F(1, 38.97) = 0.61$, $p = .439$. Neither the main effect of goal nor the main effect of temporal distance was significant, $Fs(1, 72.54) < 1.42$, $ps > .237$. [2]

Discussion

In Experiment 1, we employed a paradigm that allowed us to contrast goal-based imitation with movement-based imitation. In addition, we manipulated temporal distance between participants. The results demonstrated that participants were relatively more likely to imitate a movement than a goal when primed with temporal proximity (compared with temporal distance). Although the findings support the hypothesis that psychological distance moderates the degree to which individuals imitate movements versus goals, one needs to take into consideration two limitations. First, Experiment 1 served as pilot study. To this end, we assessed rather a small amount of participants. Since the effect of interest was significant, the small sample size could implicate on the one hand that the effect is relatively large. On the other hand, the small cell sizes (in combination with the detection of large effects) could mean that our studies were underpowered. Thus, in the next experiments we aimed at applying a full within-subjects design in order to gain statistical power. Second, another limitation of the present experimental paradigm is that goal-based and movement-based imitation were confounded in such a way that more goal imitation meant less movement imitation, and vice versa. Therefore, in Experiments 2 and 3, we used a paradigm that allowed us to dissociate goal-based imitation from movement-based imitation.

Experiment 2

To better disentangle goal-based from movement-based imitation and to corroborate our initial findings, in Experiment 2 we used a within-subject design and another imitation paradigm that allowed us to gain more statistical power. Specifically, participants performed a computerized and speeded version of the pen-and-cups task (Bekkering et al., 2000; Wohlschläger et al., 2003) that measures goal-based imitation independently of movement-based imitation. That is, we used a version of the paradigm that has been introduced by Wohlschläger and Bekkering (2002). Across multiple trials, participants watched on a computer screen the hands of a model pressing one of two keys on a keyboard by using either the right or the left hand. Participants were instructed to imitate the observed actions (i.e., they were asked to press the same key with the same hand as the model) as fast as possible. Imitation errors of hand use as well as key press were measured. Psychological distance was manipulated by presenting the model's action at either a spatially proximal or a spatially distant location on the screen while holding the depicted actions' size constant. This was done by integrating the model's actions in images that conveyed a spatial distance. Specifically, the actions were presented in a broad green arrow that pointed to either a spatially near or a spatially distant location on the picture. The same manipulation has been used previously to manipulate psychological distance (cf. Bar-Anan, Liberman, Trope, & Algom, 2007; Hansen & Wänke, 2010). We expected that participants would make relatively more movement errors (i.e., use the wrong hand) than goal errors (i.e., press the wrong key) if the actions were presented at a distant compared to a proximal location. This should be the case because the primed distance was expected to lead participants' focus more strongly on the goal than to the underlying movement and vice versa for primed proximity.

Method

Participants and design. We calculated the amount of participants with a medium-sized effect of dz = .50 in mind. In order to detect such an effect with a power of $1 - \beta = .8$ and $p = .05$ (one-tailed), 27 participants are needed. We rounded this number up and assessed thirty undergraduate psychology students (24 female, 6 male) from the University of Salzburg in return for course credit or 5 euros. Age ranged from 18 to 28 years ($M = 21.13$ years, $SD = 2.84$). The design was a 2 × 2 (Error Type [hand, key] × Spatial Distance [proximal, distant]) within-subject design. The dependent variable was the error rate.

Procedure and materials. The experiment was programmed with E-Prime software (Schneider, Eschman, & Zuccolotto, 2002). After being welcomed, participants were seated at a computer and a German keyboard with the T and U keys marked with a green and blue sticker, respectively. Instructions on the screen informed participants that they would watch a person who would press the green or the blue key on the keyboard using her right or left hand. Participants were instructed to imitate the same actions as the model as fast and accurately as possible. They were further instructed that the computer would record the key presses and a camera would record which hand they used. After these general instructions, three training blocks followed in which the task was introduced step by step.

In the first training block, participants learned the imitation procedure in eight trials. First, participants were given detailed information about what the trials would look like. We told them that they would observe in multiple trials different movements executed by another person. Specifically, we explained that they would observe another person's left or right index finger pressing either the "T" or "U" key on a computer keyboard. Participants were instructed to imitate each of the observed actions by using the same hand and by pressing the same key as the observed person. In each trial, participants first saw a written sentence instructing them to loosely place both of their index fingers on the space bar and start the trial by pressing the space bar with both fingers as soon as they were ready. After participants pressed the space bar, a blank screen was shown for 500 ms followed by a broad green vertical arrow in the middle of the screen. Within the arrow, a keyboard was presented with the index fingers of the model lying on the space bar. This picture changed after 1,000 ms to an image in which the model's hand (either right or left, depending on trial) pressed the green-marked "T" or the blue-marked "U" key (depending on trial). Participants then had to imitate the action as fast as possible. Each of the possible combinations (right or left hand used for pressing T or U) were presented twice in random order, resulting in eight exercise trials in total.

After participants learned the task, a second training block followed in which we increased response speed. We included a response window in the paradigm to increase the overall base rate of errors. That is, participants were instructed to respond within 500 ms. They learned that a green checkmark would appear if they successfully responded within the time frame. If they were too slow, a gray checkmark would appear. Participants were asked to try to attain as many green checkmarks as they could. They were further instructed that very likely their error rate would increase but that this would be less important than responding within the 500-ms window. Participants worked again on eight trials (i.e., the model used the right or left hand for pressing T or U, each two times in random order). Depending on whether participants responded within 500 ms, a green or a gray checkmark appeared 500 ms after presentation of the model's action. The checkmark was presented for 1,000 ms before the next trial started.

In the third training block, we added 16 different color photographs that have been used before to manipulate spatial distance (Hansen & Wänke, 2010). All photographs showed a landscape in which a street, an alley, a bridge, or a trail led away from the perceiver into the distance. Participants were informed that the model's action would be presented at a spatially proximal or distant location. In each trial, participants were asked to press the space bar when ready. Afterward, a blank screen appeared for 500 ms (as before). Next, one of the scenes was presented for 1,000 ms. Then, the arrow that depicted the model's action was integrated into the scene and pointed to a spot in either the foreground (proximal) or the background (distant). As before, this arrow depicted a keyboard with the model's index fingers lying on the space bar. It remained for 1,000 ms and then changed to an image of the model's action, which remained for 500 ms. During these 500 ms, participants were required to imitate the action. Participants worked through 32 speeded response trials: Each of the four hand-key combinations appeared four times in each location (distant, proximal). The size of the green arrow was held constant across all trials. Each of the 16 photographs was encountered twice (once with a proximal action, and once with a distant action). The order of trials was randomized. Figure 3 depicts the sequence of one trial.

After the three training blocks, the experimental block followed. This block was similar to the third training block, albeit with one difference: All 16 photographs were combined with all eight distance–hand–key combinations, resulting in 128 trials in total. The order of trials was randomized. A camera recorded which hand participants used (left or right). The computer recorded whether participants pressed the same key as the model. At the end of the session, demographic data were collected and participants were thanked, debriefed, and paid.

Results

In line with research on the pen-and-cups task (e.g., Bekkering et al., 2000; Wohlschläger et al., 2003) and paradigms similar to ours (e.g., Wohlschläger & Bekkering, 2002), we analyzed participants' error rates. Only those trials in which participants responded within the response window were analyzed (62% of all trials, which were equally distributed across conditions, $\chi^2 < 1$). Key errors and hand errors in these trials were used as dependent variables. Key errors were defined as the proportion of trials in which participants pressed a different key from the model (i.e., pressing T when the model pressed U, pressing U when the model pressed T). Hand errors were defined as the proportion of trials in which participants used a different hand from the model.

A generalized linear mixed-effects regression model with a Poisson distribution and logistic link function was fitted to the errors, using the glmer procedure of the lme4 package in the R programming environment (Bates, Mächler, Bolker, & Walker, 2014). We performed a series of generalized linear mixed-effects models (see Table 1), specifying first the random intercepts and slopes for subjects. Then, we considered error type and distance separately as fixed effects. Adding the effect of error type to the model with just the random intercepts and slopes for subjects did significantly improve the fit of the model, $\chi^2(1) = 125.85$, $p < .001$, and this effect was found to be negative, indicating that participants committed more hand (movement) errors ($M = 7.72\%$, $SD = 8.20$) than key (goal) errors ($M = 1.43\%$, $SD = 1.10$), estimate = −1.73, $SE = 0.18$, $z = -9.62$, $p < .001$ (see Figure 4). This effect replicates previous findings on the pen-and-cups task (Bekkering et al., 2000; Wohlschläger et al., 2003). The inclusion of the effect of distance did not significantly improve the fit of the model compared to the model with just the random intercepts and slopes for subjects, $\chi^2(1) = 3.66$, $p = .056$.

Including the interaction between distance and error type as a fixed effect to the model with the two main effects and the random intercept and slopes for subjects increased the goodness of fit, $\chi^2(1) = 29.05$, $p < .001$. The interaction was significant (estimate = −2.81, *SE* = 0.73, z = −3.85, $p < .001$), suggesting that the effect of error type on error rate varied as a function of distance. Simple comparisons revealed that participants showed more key (goal) errors when the action was proximal (*M* = 2.69%, *SD* = 1.78) than when it was distant (*M* = 0.15%, *SD* = 0.57), estimate = −2.80, *SE* = 0.73, $z = -3.85$, $p < .001$. The proportion of hand (movement) errors did not differ between the proximal (*M* = 7.60%, *SD* = 7.80) and distant (*M* = 7.85%, *SD* = 9.15) conditions, estimate = 0.01, *SE* = 0.14, $z = 0.11$, $p = .914$.

Discussion

In Experiment 2, we aimed at gaining more statistical power by using a speeded and computerized adaption of the pen-and-cups task (cf. Bekkering et al., 2000; Wohlschläger et al., 2003), which allowed us to manipulate spatial distance trial by trial. The main effect of error type replicates findings of previous research on the pen-and-cups task (Avikainen et al., 2003; Bekkering et al., 2000; Wohlschläger & Bekkering, 2002), demonstrating that people make fewer goal errors than movement errors when imitating another person's behavior. Crucially, however, in line with our hypothesis, psychological distance reduced goal errors, suggesting that people are better able to focus on goals when imitating distant (compared to proximal) actions. This finding conceptually replicates the findings of Experiment 1. However, whereas in Experiment 1 goal-based and movement-based imitation was confounded in such a way that more goal-based imitation meant less movement-based imitation and more movement-based imitation less goal-based imitation, the paradigm of Experiment 2 allowed us to actually dissociate goal-based and movement-based imitation. Nevertheless, we found that distance differentially affected goal-based imitation versus movement-based imitation, lending strong support to our hypothesis.

Experiment 3

In Experiment 3 we aimed to replicate the findings of Experiment 2 with a larger sample and address a possible confound. Specifically, while the model's behavior was presented distally versus proximally, at the same time the behavior appeared on the top versus the bottom of the screen, which is an inherent feature of manipulating spatial distance with Ponzo-illusion-like stimulus pictures. To rule out verticality (top versus bottom) as a key driver of the found interaction, we added a between-subject condition in Experiment 3 in which the model's actions were presented on the top versus the bottom of the screen without presenting any pictures. We expected to replicate the findings of Experiment 2, that is, participants would make relatively more movement errors (i.e., use the wrong hand) than goal errors (i.e., press the wrong key) if the actions were presented at a distant compared to a proximal location. We did not predict this effect when the behavior was presented at the top compared to the bottom of the screen (without a distance manipulation).

Method

Participants and design. In order to estimate the sample size a-priori, we conducted an analysis with G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007). Based on an effect size of $\eta_p^2 = .06$ (the effect found in Experiments 1, which is more conservative than using the larger effect size of Experiment 2), a power of $1-\beta = .90$, an alpha error probability of $\alpha = .05$, and an assumed correlation among the repeated measures of $r = .41$ (based on Experiment 2), the optimal sample size for the replication study is $N = 51$ participants. We doubled the calculated amount of participants, because we added an additional between-subject factor to the design. One-hundred and two psychology students (78 female, 24 male) from the University of Salzburg participated in exchange for course credit or 4 euros. Age ranged from 18 to 59 years ($M = 22.62$ years, $SD = 5.29$). The design was a 2 × 2 × 2 (Error Type [hand, key] × Spatial

Distance/Verticality [proximal/bottom, distant/top] × Presence of Pictures [yes: Spatial Distance, no: Verticality]) mixed design with the last factor manipulated between participants. The dependent variable was the error rate.

Procedure and materials. The experiment was an exact replication of Experiment 2 with one exception: For the verticality condition, in which the model's actions appeared on the bottom versus the top of the screen, we omitted all spatial distance pictures. That is, in the condition in which no pictures were presented, participants were informed that the model's action would be presented at the bottom or the top of the screen (instead of a spatially proximal or distant location) in the third training block and in the experimental block. In the experimental block, all participants gave responses to 128 trials in total, as in Experiment 2. The order of trials was randomized. As in Experiment 2, a camera recorded which hand participants used (left or right). The computer recorded whether participants pressed the same key as the model. At the end of the session, demographic data were collected and participants were thanked, debriefed, and paid.

Results

As in Experiment 2, we analyzed participants' error rates. Only those trials in which participants responded within the response window were analyzed (42% of all trials, which were equally distributed across conditions, $\chi^2 < 1$). As in Experiment 2, key errors and hand errors in these trials were used as dependent variables. Key errors were defined as the proportion of trials in which participants pressed a different key from the model (i.e., pressing T when the model pressed U, pressing U when the model pressed T). Hand errors were defined as the proportion of trials in which participants used a different hand from the model.

A generalized linear mixed-effects regression model with a Poisson distribution and logistic link function was fitted to the errors, specifying the random intercepts and slopes for subjects, error type, distance, and condition (i.e., presence vs. absence of spatial distance pictures), all two-way interactions, and the three-way interaction as fixed effects. Preliminary analyses showed that the model which included the three-way interaction differed significantly from the model that did not include the three-way interaction, $\chi^2(1) = 6.99$, $p = .008$. The three-way interaction was significant (estimate = 3.08, $SE = 1.27$, $z = 2.43$, $p = .015$, see Figure 5), indicating that the pattern of errors differed between the condition in which pictures were included (i.e., in which spatial distance was manipulated) and the condition in which no pictures were shown (i.e., in which just verticality was manipulated). To understand the nature of this three-way interaction, we analyzed the error rates separately for the two conditions. For each condition, we performed a series of generalized linear mixed-effects models (see Tables 2 and 3), specifying first the random intercepts for subjects. Then, we considered error type and distance separately as fixed effects, before entering the interaction term, as in Experiment 2.

For the condition in which spatial distance was manipulated, adding the effect of error type to the model with just the random intercepts for subjects did significantly improve the fit of the model, $\chi^2(1) = 81.14$, $p < .001$. This effect was found to be negative, indicating that participants committed more hand (movement) errors ($M = 4.5\%$, $SD = 10.5$) than key (goal) errors ($M = 1.1\%$, $SE = 1.3$), estimate = −1.55, $SE = 0.20$, $z = -7.84$, $p < .001$. Adding the effect of spatial distance to the model with just the random intercepts for subjects did also significantly improve the fit of the model, $\chi^2(1) = 9.25$, $p = .002$. This effect was found to be negative, indicating that participants committed more errors when the model was proximal ($M = 3.5\%$, $SD = 5.9$) than distant ($M = 2.1\%$, $SD = 4.9$), estimate = −0.46, $SE = 0.15$, $z = -3.00$, $p = .003$. Replicating the finding of Experiment 2, the main effects were qualified by a significant interaction, estimate = −3.24, $SE = 1.03$, $z = -3.15$, $p = .002$ (see Figure 5A). The model which included the interaction term differed significantly from the model which did not include the interaction, $\chi^2(1) = 25.54$, $p < .001$. Simple comparisons revealed that participants showed more key (goal) errors when the action was proximal (*M* = 2.15%, *SD* = 2.29) than when it was distant (*M* = 0.05%, *SD* = 0.33), estimate = −3.37, *SE* = 1.02, $z = -3.32$, $p < .001$. The proportion of hand (movement) errors did not differ between the proximal (*M* = 4.91%, *SD* = 11.3) and distant (*M* = 4.07%, *SD* = 9.9) conditions, estimate = −0.17, *SE* = 0.17, $z = -1.00$, $p = .32$.

In the condition in which no pictures were present (see Figure 5B), adding the effect of error type to the model with just the random intercepts for subjects did significantly improve the fit of the model, $\chi^2(1) = 216.61$, $p < .001$, and this effect was found to be negative, indicating that participants committed more hand (movement) errors (*M* = 7.5%, *SD* = 14.0) than key (goal) errors (*M* = 0.3%, *SD* = 0.8), estimate = −3.20, *SE* = 0.36, $z = -8.88$, $p < .001$. The model that included the verticality factor differed also from the model with just the random intercepts for subjects, $\chi^2(1) = 6.77$, $p = .009$. The main effect of verticality was negative, estimate = −0.37, *SE* = 0.14, $z = -2.58$, $p = .010$, indicating that participants made more errors when the models actions were presented at the bottom (*M* = 4.5%, *SD* = 7.4) than at the top (*M* = 3.4%, *SD* = 7.3). The interaction was not significant, estimate = −0.15, *SE* = 0.74, $z = -0.20$, $p = .84$, and the model including the interaction did not differ from the model including only the main effects and the random intercepts for subjects, $\chi^2(1) = 0.04$, $p = .84$.

Discussion

The findings of Experiment 3 replicated the effect found in Experiment 2: Participants made fewer goal errors than movement errors when imitating another person's behavior, suggesting that they imitated goals more strongly than movements. Interestingly, in Experiment 2 and 3, the standard deviation was smaller for goal (i.e., key) errors than for movement (i.e., hand) errors. This can be explained by the fact that participants made almost no errors in the goal condition. More important for our predictions, however, was the significant interaction between psychological distance and error type. This effect suggests that participants were better able to focus on goals when imitating distant (compared to proximal) actions.

The goal of the present experiment was to rule out an alternative explanation of the findings, namely that a presentation on the vertical dimension would be responsible for differences in goal and movement errors. To test this alternative explanation, we added a between-subject condition in which the model's actions were presented on the top versus the bottom of the screen without presenting any distance pictures. In contrast to the alternative explanation, the results suggest that movement imitation was enhanced when the action was presented at the top of the screen (i.e., participants made fewer movement errors here).

Although the finding in the control condition, which indicated that participants made fewer movement (hand) errors when the actions were presented at the top than at the bottom of the screen, speaks against the alternative explanation, it was unexpected and needs further explanation. A plausible explanation of this effect is that during the experiment participants most likely directed their attention to the middle of the screen at the beginning of each trial because (1) they were instructed to do so in the training blocks (since the actions were presented in the middle of the screen) and (2) directing attention to the middle of the screen was a useful strategy for responding quickly as the actions in the experimental block were randomly presented at the top or at the bottom of the screen. Importantly, when an action appeared at the top of the screen, the hands of the model were closer to the middle of the screen (and therefore more into the attentional focus) than when an action appeared at the bottom of the screen. Therefore, it might well be that the model's hands were more salient when the action was presented at the top of the screen. This may have resulted in fewer hand errors when the actions appeared at the top than at the bottom. Since the aim of the present research was to test the influence of psychological distance on imitation, we did not further investigate the effects of the movement's vertical location on imitation. However, future research may aim at shedding more light on this finding and test our preliminary interpretation.

Note that because in the experimental condition (i.e., the condition with the distance pictures) the location of the presented actions varied from top to bottom in the same way as in the control condition but did not result in the unexpected position effect, the manipulation of psychological distance might be even stronger than previously assumed. That is, if a position at the top increases the focus on the hands (and therefore reduces hand errors), the finding that hand imitation was not affected by distance strengthens our claim that distance (vs. proximity) reduces movement imitation. In any case, while the effect of the vertical position on movement errors in the control condition (without distance) was unexpected and awaits further examination, it is important to note that it does not compromise the central conclusion of our research—namely that psychological distance, compared to psychological proximity, fosters goal-based as compared to movement-based imitation.

Experiment 4

The previous experiments demonstrate that psychological distance moderates the relation between goal-based and movement-based imitation. Yet an open question is at which point during the imitative process psychological distance is operating. Research on imitation suggests that imitative behavior can either be modulated at the input or output level (Heyes, 2011). Input modulation means that moderating variables guide attention towards certain features of a movement, which in turn facilitates the imitation of those features. If psychological distance operates at the input level, psychological proximity should direct attention to low level features such as the model's selection of the hand and psychological distance should guide attention towards higher level features, such as the model's selection of a key. Attention to the respective action feature would subsequently reduce the respective errors during imitation. Conversely, output modulation would mean that psychological distance influences the execution rather than the perception of action features. Here, one would argue that psychological proximity facilitates the execution of finger movements whereas psychological distance facilitates the selection of keys. Similar to research on imitation, research in the realm of construal level theory suggests that psychological distance can operate both at the input as well as the output level (Amit, Mehoudar, Trope, & Yovel, 2012; Soderberg, Callahan, Kochersberger, Amit, & Ledgerwood, 2015; Wakslak, Trope, Liberman, & Alony, 2006). To test whether psychological distance influences imitation at the input or the output level, we conducted Experiment 4. The experiment was similar to Experiment 2 and 3 with one critical difference: Instead of assessing actual imitation, we used a discrimination task. That is, in each trial, participants indicated whether the other person (1) used her left or right hand and (2) pressed the "T" or "U" key. If our previous effects are due to input modulation, one should expect that psychological distance affects discrimination in a similar way as it affects imitation. If, however, the effects are based on output modulation only, one should not expect an effect of psychological distance in the discrimination task.

Method

Participants and design. We aimed at achieving similar statistical power as in Experiment 3. Thus, 51 students (35 female, 16 male) from the University of Cologne were recruited to participate into the experiment in exchange for 4 euros. Age ranged from 18 to 59 years (*M* = 23.39 years, *SD* = 3.83). The design was a 2 × 2 (Error Type [hand, key] × Spatial Distance [proximal, distant]) within-subject design. The dependent variable was the error rate.

Procedure and materials. The procedure and the materials were similar to Experiment 2, with one exception: Instead of imitating the observed actions, participants indicated which hand the model used and which key the model pressed.

The experiment consisted of a training block and an experimental block. In the training block, each trial started with a blank screen shown for 1,000 ms followed by a broad green vertical arrow in the middle of the screen presented for 1,000 ms. Within the arrow, a keyboard was shown with the index fingers of the model lying on the space bar. Then, an image in which the model's hand (either right or left, depending on trial) pressed the green-marked "T" or the blue-marked "U" key (depending on trial) was presented for 500 ms. Afterwards, participants were asked to indicate which hand the model had used and which key she had pressed by pressing the "Q" or "P" key on the computer keyboard. The order of the questions (i.e., hand-use first vs. key-press first) was counterbalanced across participants. Each of the possible combinations (right or left hand used for pressing T or U) was presented twice in random order, resulting in eight training trials in total.

In the experimental block we used the same trial structure, but presented the movements in the photographs used in Experiment 2 and 3 to manipulate psychological distance. In line with our previous experiments, participants responded to 128 trials in total. The dependent variable was the amount of errors (in percent) participants made in indicating the observed actions. At the end of the experiment, participants were thanked, debriefed, and paid.

Results

A generalized linear mixed-effects regression model with a Poisson distribution and logistic link function was fitted to error. As in Experiment 2, we performed a series of generalized linear mixed-effects models (see Table 4), specifying first the random intercepts and slopes for subjects. Then, we considered error type and distance separately as fixed effects. Adding the effect of error type to the model with just the random intercepts and slopes for subjects did not significantly improve the fit of the model, $\chi^2(1) = 0.42$, $p = .519$. However, including the effect of distance significantly improved the fit of the model compared to the model with just the random intercepts and slopes for subjects, $\chi^2(1) = 7.06$, $p = .008$. This main effect of distance was negative, indicating that participants made more errors when the action was depicted in proximity ($M = 1.78\%$, $SD = 1.48$) than when it was depicted in distance ($M = 1.21\%$, $SD = 1.91$), estimate = −0.38, $SE = 0.14$, $z = -2.71$, $p = .007$.

The main effect of distance was qualified by error type (see Figure 6): Including the interaction between distance and error type as a fixed effect to a model with the two main effects and the random intercept and slopes for subjects increased the goodness of fit, $\chi^2(1) = 26.16$, $p < .001$. The interaction was significant, estimate = 1.55, $SE = 0.31$, $z = 5.04$, $p < .001$. Simple comparisons revealed that participants made more errors in indicating which key (goal) the model person pressed when the model was proximal ($M = 2.39\%$, $SD = 1.57$) than when the model was distant ($M = 0.74\%$, $SD = 1.44$), estimate = −1.18, $SE = 0.23$, $z = -5.07$, $p < .001$. In contrast, participants made fewer errors in indicating which hand the model person used when the model was proximal ($M = 1.16$, $SD = 1.92$) than when the model was distant ($M = 1.69\%$, $SD = 2.83$), although this latter difference was not significant, estimate = 0.37, $SE = 0.21$, $z = 1.75$, $p = .080$.

Discussion

Experiment 4 tested to which degree psychological distance affects participants' ability to discriminate between left and right hand selection as well as left and right key presses. The results demonstrate that participants made more errors when indicating which key a model pressed when the model was proximal than when the model was distant. In contrast, participants tended to commit more errors in indicating the correct hand use of distant compared to proximal models. This result mirrors the findings of Experiments 2 and 3. It suggests that psychological distance operates at the input level. That is, psychological proximity increases attention to low level features, such as movements. Conversely, psychological distance increases attention to higher level features, such as goals (here key selection).

General Discussion

Previous research on imitation has shown that people adopt others' goals and/or mirror their exact movement patterns when imitating them. Whereas previous research focused on either movement-based or goal-based imitation, we investigated for the first time whether situational influences moderate the degree of movement-based versus goal-based imitation. The present findings suggest that psychological distance moderates the degree to which individuals imitate a model's goal or movement. Across four experiments, we found that participants engaged in relatively more movement-based imitation than goal-based imitation when the model was psychologically proximal (compared to distant). In Experiment 1, we contrasted goal-based imitation with movement-based imitation. Participants watched a model pursue a goal (i.e., to drink a lot or a little) by performing specific movements (i.e., sorting cups to the right or left side). Participants likewise chose how much they would like to drink by placing cups on their right or left side. Critically, the experimental setup was arranged in such a way that participants had to engage in movements opposed to the model's movements when imitating the model's goal and to follow an opposite goal when imitating the model's movements. We found that participants were more likely to imitate the model's movements than the model's goals when they were primed with temporal proximity (compared to temporal distance). While Experiment 1 might be underpowered and should be regarded as a pilot study, Experiments 2 and 3 measured goal-based and movement-based imitation independently of each other in a higher-powered and better controlled within-subject design. That is, we used an adapted pen-and-cups paradigm in which participants imitated presses on specific keys with the left or right hand as quickly as possible. Although participants were significantly less likely to make key than hand errors in both conditions, this difference was more pronounced when the model was spatially distant, suggesting that participants more strongly imitated the model's goal (i.e., pressing the correct key) when the model was distant than when the model was near. Taken together, the findings of the three experiments support the hypothesis that psychological distance moderates the degree to which individuals imitate movements versus goals. In Experiment 4, we used the same paradigm as in Experiment 2 and 3 to test whether our effects are based on input or output modulation. In Experiment 4 participants did not imitate the observed movements, but indicated whether the model used her left or right hand and whether she pressed the left or right key. The results speak in favor of input modulation, because participants made more errors when indicating which key a model had pressed when the model was proximal than when the model was distant. In contrast, participants tended to commit more errors in indicating the correct hand of distant compared to proximal models.

Theoretical implications and future directions

In line with construal level theory (Trope & Liberman, 2003, 2010) we suggest that psychological distance leads people to construe a model's behavior more abstractly, which in turn increases their focus on the model's goals rather than on his or her specific movements. Conversely, psychological proximity leads observers to construe the model's behavior more concretely, resulting in a greater focus on the model's specific movements rather than goals. In our research, we manipulated psychological distance in several ways. Whereas in Experiment 1 psychological distance was an unrelated prime, in Experiments 2 to 4 psychological distance of the actions was directly manipulated. Irrespective of the manipulation, the effect on imitation was similar. Past research conducted in the framework of construal level theory (Trope & Liberman, 2003, 2010) has shown that people tend to represent distant (vs. proximal) behavior in terms of relatively abstract goals even when the behavioral information at hand is held constant (e.g., Fujita et al., 2006; Liberman & Trope, 1998; see reviews by Liberman & Trope, 2008; Trope & Liberman, 2010). Similarly, our findings suggest that the same behavior is imitated differently depending on whether the behavior is framed as psychologically proximal or distant. Proximal framing promotes movement-based imitation, whereas distant framing promotes goal-based imitation.

In addition, the present evidence for distance-dependent changes in imitation is consistent with construal level theory insofar as it suggests that concrete and abstract construals serve the functional role of guiding responses to near and distant objects (see Kalkstein et al., 2016). Because proximal models share the idiosyncratic specifics of the observer's immediate context, low-level imitation with its focus on concrete movements supports social learning from proximal models. High-level imitation, which involves construing the models' action in terms of more abstract and invariant goals, affords social learning from distant models—those who do not share the idiosyncratic features of the observer's immediate context. High-level imitation thus serves to expand the range of people one can learn from.

Besides implications for construal level theory, our findings have important implications for the understanding of imitation. Previous research has found evidence for both goal-based and movement-based imitation by studying them as two separate phenomena. However, little attention has been paid to the interplay between the two types of imitation. Our research suggests that goal- versus movement-based imitation might lie on a continuum and be influenced by characteristics of the situation. Depending on psychological distance, imitation of the same behavior may shift toward the goal or the movement end of the continuum. Initial support for this view comes from recent findings demonstrating that psychological distance can reduce imitation of concrete movements when learning a novel activity (Hansen et al., 2016). However, this finding does not rule out the argument that psychological distance simply reduces all kinds of imitation. Thus, the present research extends this finding by demonstrating that psychological distance not only reduces imitation of movements but also enhances imitation of goals. Thus, it seems rather unlikely that psychological distance diminishes all kinds of imitation.

In addition, our research extends the research of Hansen et al. (2016) in another way. Hansen et al. used a task in which participants learned a novel behavior. Thus imitation happened on a rather explicit level. In our first Experiment participants were not aware of the other person's influence on their own behavior. Likewise, in Experiments 2 and 3, the task required speeded responses, allowing us to measure more automatic imitation tendencies (cf. Brass et al., 2000). In this sense, the present findings reveal that psychological distance does not only affect the learning of novel behaviors but also an unintentional imitation of well-learned activities.

Our studies also have implications for a current debate in the research on imitation. Recently, it has been suggested that imitation is not as strongly modulated by social top-down influences (cf., Cracco, Bardi, et al., 2018; Cracco & Brass, 2019; Genschow et al., 2017; Ramsey, 2018) as had been argued previously (e.g., Wang & Hamilton, 2012). However, the critique of social top-down modulations has focused on research investigating movement imitation only. The current research, however, found social top-down modulations (i.e., psychological distance) in a an experimental paradigm that assessed both movement-based and goal-based imitation. It might well be that certain social factors affect only one form of imitation or both forms in opposite directions. Future research using paradigms that allow assessing movement-based and goal-based imitation may thus be better suited for examining the processes underlying social top-down modulations.

In our studies, we manipulated temporal and spatial distance. Construal level theory (Trope & Liberman, 2003, 2010), however, distinguishes between four dimensions of psychological distance: spatial, temporal, social, and hypothetical. It is possible that, like temporal and spatial distance, social and hypothetical distance also modulate the degree to which people imitate goals or movements. For instance, it might well be that high social power, as a form of social distance (Smith & Trope, 2006), increases goal-based (and decreases movement-based) imitation. Moreover, various other factors that affect the level of construal of an observed behavior may also influence the degree of goal-based versus movement-based imitation. For instance, a happy mood (Gasper & Clore, 2002), musical cues that are related to distance (such as reverberation and unfamiliar harmonies; Hansen & Melzner, 2014), and thoughts about money (Hansen, Kutzner, & Wänke, 2013) have been shown to promote more abstract construal. Future research could further explore whether these factors also modulate the level of imitation.

Finally, our research has important implications for learning. Individuals learn through imitation in order to acquire skills (e.g., Bandura, 1977, 1986). While it is often important to extract the goal of a movement by observing others, it is sometimes also important to learn the exact execution of a movement. While distant models might be more useful in the former situation, proximal models might be more useful in the latter situation. In other words, learning the general plans and strategies of a behavior might be facilitated by distant models, whereas learning specific moves and techniques might be facilitated by proximal models.

Conclusion

While some research suggests that individuals imitate in a goal-based manner, other research suggests that imitation is rather movement-based. Although both forms of imitation are essential, past research focused either on one or on the other. The present research examined both levels of imitation and showed that psychological proximity as compared to psychological distance relatively fostered movement-based compared to goal-based imitation. Moreover, our research indicates that this modulation most likely operates at the input level. The present research thus integrates the two forms of imitation within a framework that views imitation as flexibly modulated in line with the characteristic of the model and the situation in which it takes place.

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Footnotes

[1] In addition, we conducted another pilot study that replicates the basic findings of Hansen et al. (2016) with another method—that is, with a cross–contextual imitation paradigm (cf. Genschow & Florack, 2014; Genschow et al., 2013; Genschow & Schindler, 2016). We report this study in the supplementary material.

[2] Likewise, a parametric 2 × 2 (Drinking Goal [a lot, a little] × Temporal Distance [next day, in 1 year]) ANOVA yielded a significant interaction between drinking goal and temporal distance, $F(1, 76) = 5.21$, $p = .025$, $\eta_p^2 = .06$. Contrast analyses indicated that participants who wrote about their life the next day were more likely to imitate the movement of the model by placing more cups on the same side as the model, resulting in more cups on the “drink” placemat when the model’s goal was to drink only one drink ($M = 5.06$, $SD = 2.31$) than when the model’s goal was to drink eight drinks ($M = 3.52$, $SD = 2.21$), $t(37) = 2.12$, $p = .041$, $d = .68$. The same contrast analysis for participants who wrote an essay about their life in one year did not reach significance, $t(39) = 1.06$, $p = .297$. Neither the main effect of goal nor the main effect of temporal distance was significant, $Fs(1, 76) < 1.08$, $ps > .30$.

Table 1

Generalized Linear Mixed–effects Regression Results in Study 2

Model	**Fixed effect**	**Estimate**	***SE***	***z***	***p***
1	Intercept	−3.34	0.19	−20.02	< .001
2	Intercept	−2.81	0.17	−16.62	< .001
	Error type	−1.73	0.18	−9.62	< .001
3	Intercept	−3.22	0.18	−18.29	< .001
	Distance	−0.25	0.13	−1.94	.052
4	Intercept	−2.69	0.18	−15.10	< .001
	Error type	−1.73	0.18	−9.62	< .001
	Distance	−0.25	0.13	−1.94	.052
5	Intercept	−2.81	0.18	−15.39	< .001
	Error type	−1.10	0.20	−5.56	< .001
	Distance	0.01	0.14	0.109	.913
	Error type × Distance	−2.80	0.73	−3.85	< .001

Table 2

Generalized linear mixed–effects regression results in Experiment 3 (condition in which stimuli were presented in proximity versus in distance)

Model	**Fixed effect**	**Estimate**	***SE***	***z***	***p***
1	Intercept	−4.17	0.20	−20.56	< .001
2	Intercept	−3.67	0.21	−17.83	< .001
	Error type	−1.55	0.20	−7.84	< .001
3	Intercept	−3.97	0.21	−18.80	< .001
	Distance	−0.46	0.15	−3.00	.003
4	Intercept	−3.47	0.21	−16.21	< .001
	Error type	−1.55	0.20	−7.84	< .001
	Distance	−0.46	0.15	−3.00	.003
5	Intercept	−3.60	0.22	−16.41	< .001
	Error type	−0.97	0.21	−4.52	< .001
	Distance	−0.16	0.17	−0.95	.34
	Error type × Distance	−3.24	1.03	−3.15	.002

Table 3

Generalized linear mixed–effects regression results in Experiment 3 (condition in which stimuli were presented at the bottom versus at the top)

Model	**Fixed effect**	**Estimate**	***SE***	***z***	***p***
1	Intercept	−4.43	0.33	−13.35	< .001
2	Intercept	−3.77	0.33	−11.37	< .001
	Error type	−3.20	0.36	−8.88	< .001
3	Intercept	−4.26	0.34	−12.67	< .001
	Verticality	−0.37	0.14	−2.58	.01
4	Intercept	−3.61	0.34	−10.72	< .001
	Error type	−3.20	0.36	−8.88	< .001
	Verticality	−0.37	0.14	−2.58	.01
5	Intercept	−3.61	0.34	−10.72	< .001
	Error type	−3.14	0.46	−6.89	< .001
	Verticality	−0.36	0.14	−2.49	.013
	Error type × Verticality	−0.15	0.74	−0.20	.84

Table 4

Generalized Linear Mixed–effects Regression Results in Study 4

Model	**Fixed effect**	**Estimate**	***SE***	***z***	***p***
1	Intercept	−4.49	0.14	−32.52	< .001
2	Intercept	−4.45	0.15	−29.00	< .001
	Error type	−0.09	0.14	−0.66	.509
3	Intercept	−4.32	0.15	−28.86	< .001
	Distance	−0.38	0.14	−2.70	.007
4	Intercept	−4.27	0.16	−26.08	< .001
	Error type	−0.09	0.14	−0.66	.509
	Distance	−0.38	0.14	−2.70	.007
5	Intercept	−4.02	0.16	−24.76	< .001
	Error type	−0.72	0.19	−3.73	< .001
	Distance	−1.18	0.23	−5.18	< .001
	Error type × Distance	1.55	0.30	5.04	< .001

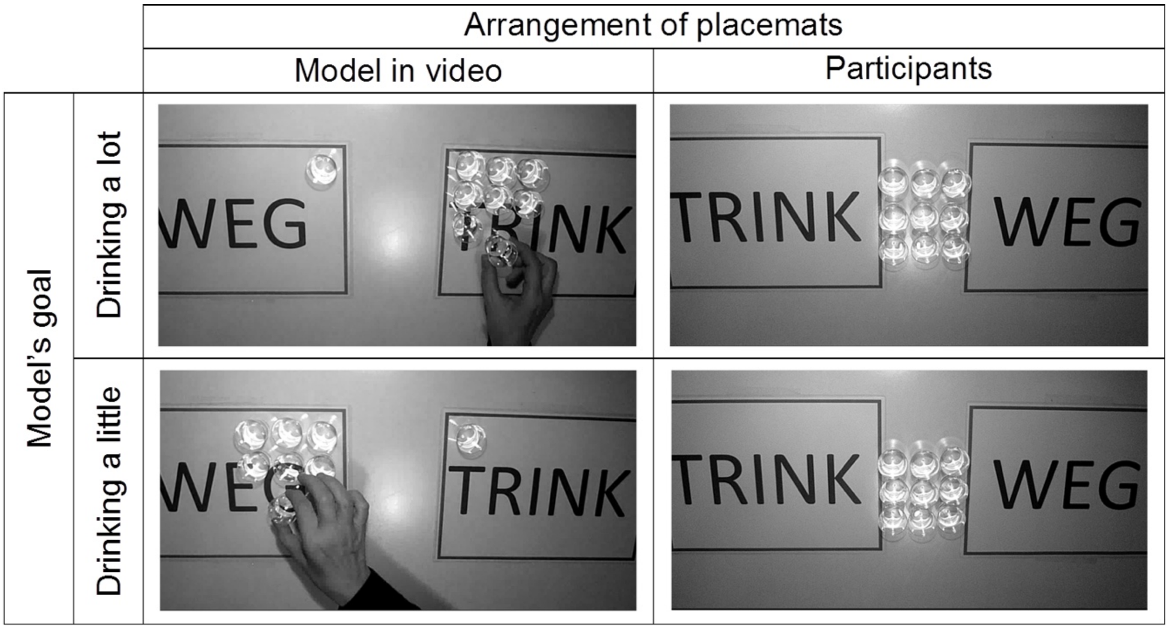

Figure 1. Screenshots from the paradigm used in Experiment 1. Note that the order of participants’ placemats was always opposite to model’s order. That is, when the “weg” (away) labeled placemat was on the model’s left (right) side, it was on participants’ left (right) side and vice versa for the “trink” (drink) labeled placemat.

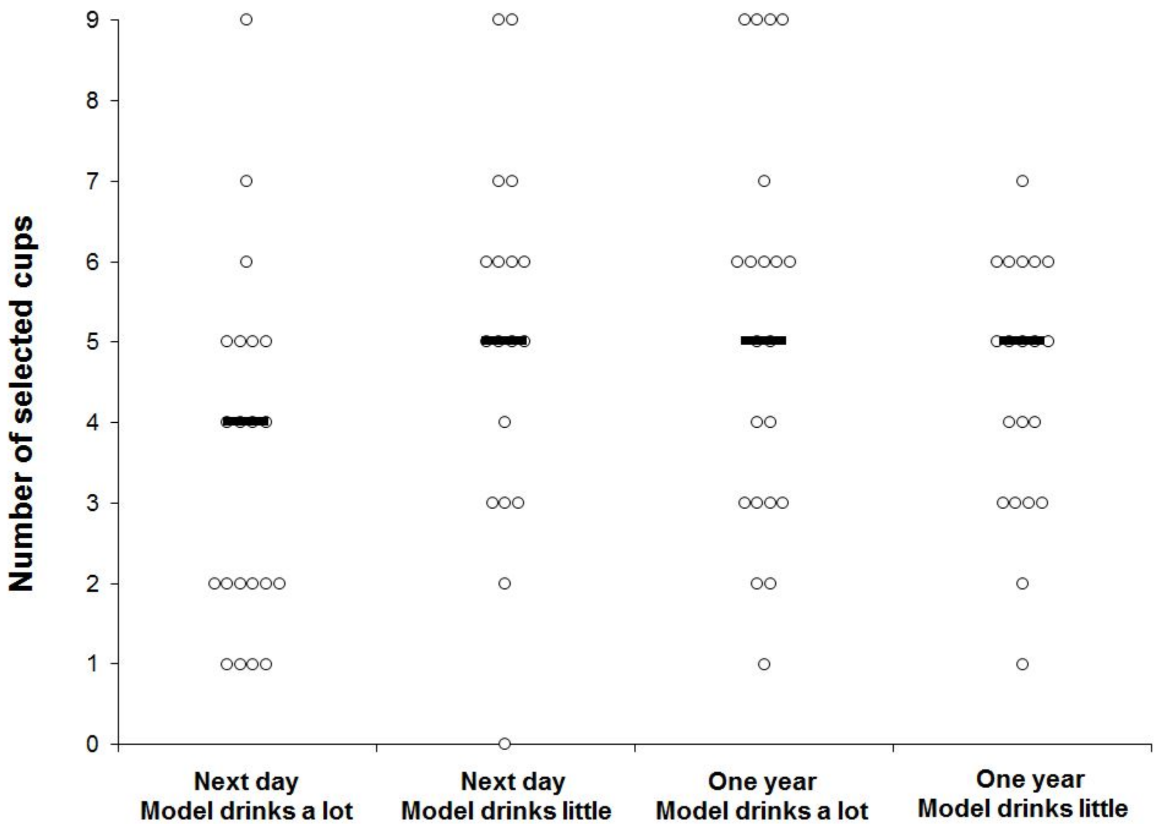

Figure 2. Number of selected cups as a function of temporal distance (next day/one year) and the model's goal (drinking a lot/drinking little) in Experiment 1. Solid lines indicate the medians, the dots indicate individual responses.

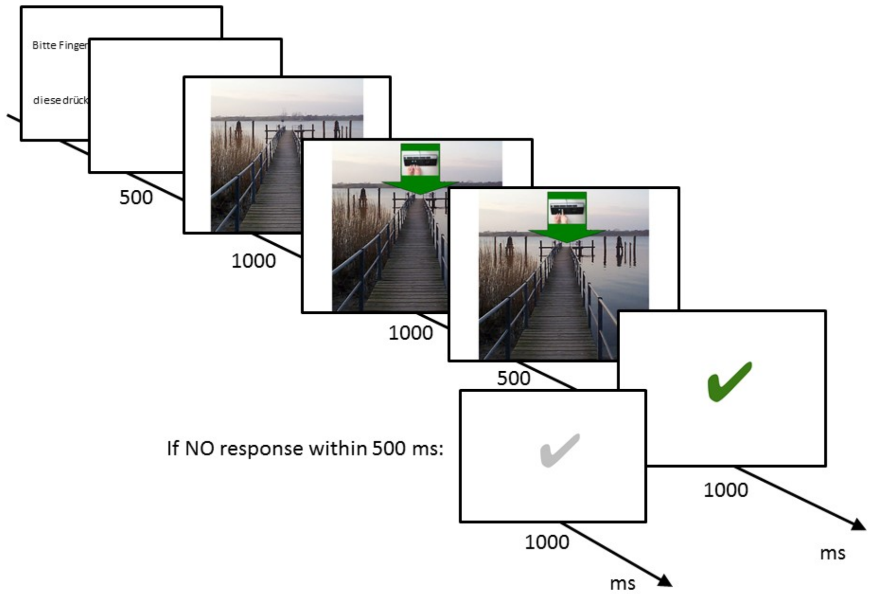

Figure 3. The sequence of one trial in the third training block and in the experimental block in Experiment 2. In the second training block, the arrows appeared in the middle of the screen without the landscapes. In the first training block, the arrows appeared in the middle of the screen without the landscapes, and the response feedback (gray or green checkmark) did not appear.

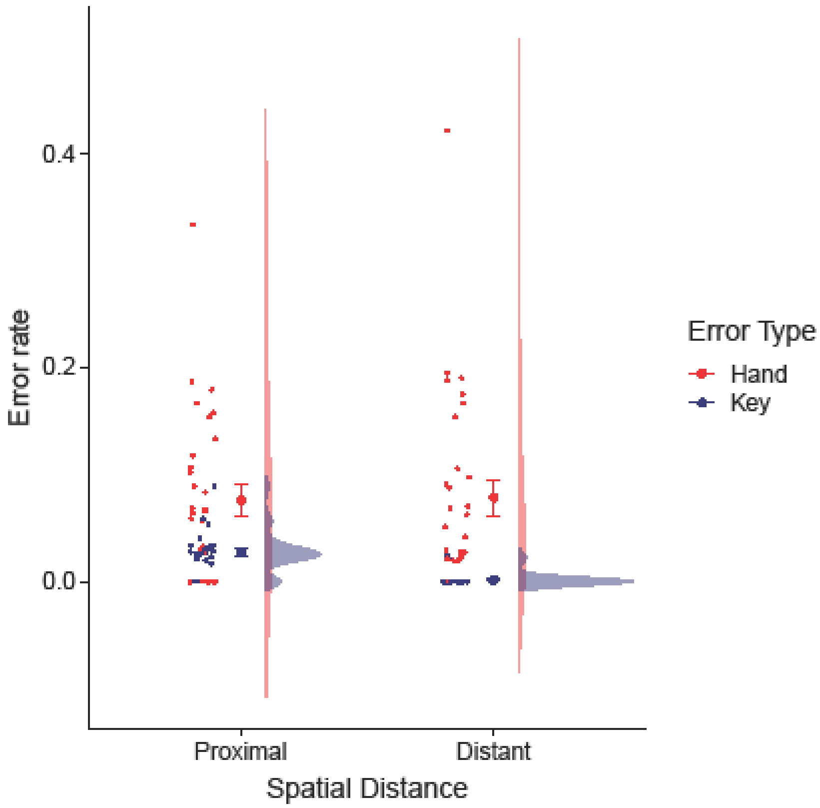

Figure 4. The error rate in speeded imitation as a function of error type (hand, key) and spatial distance (proximal, distant) in Experiment 2. Error bars indicate standard errors.

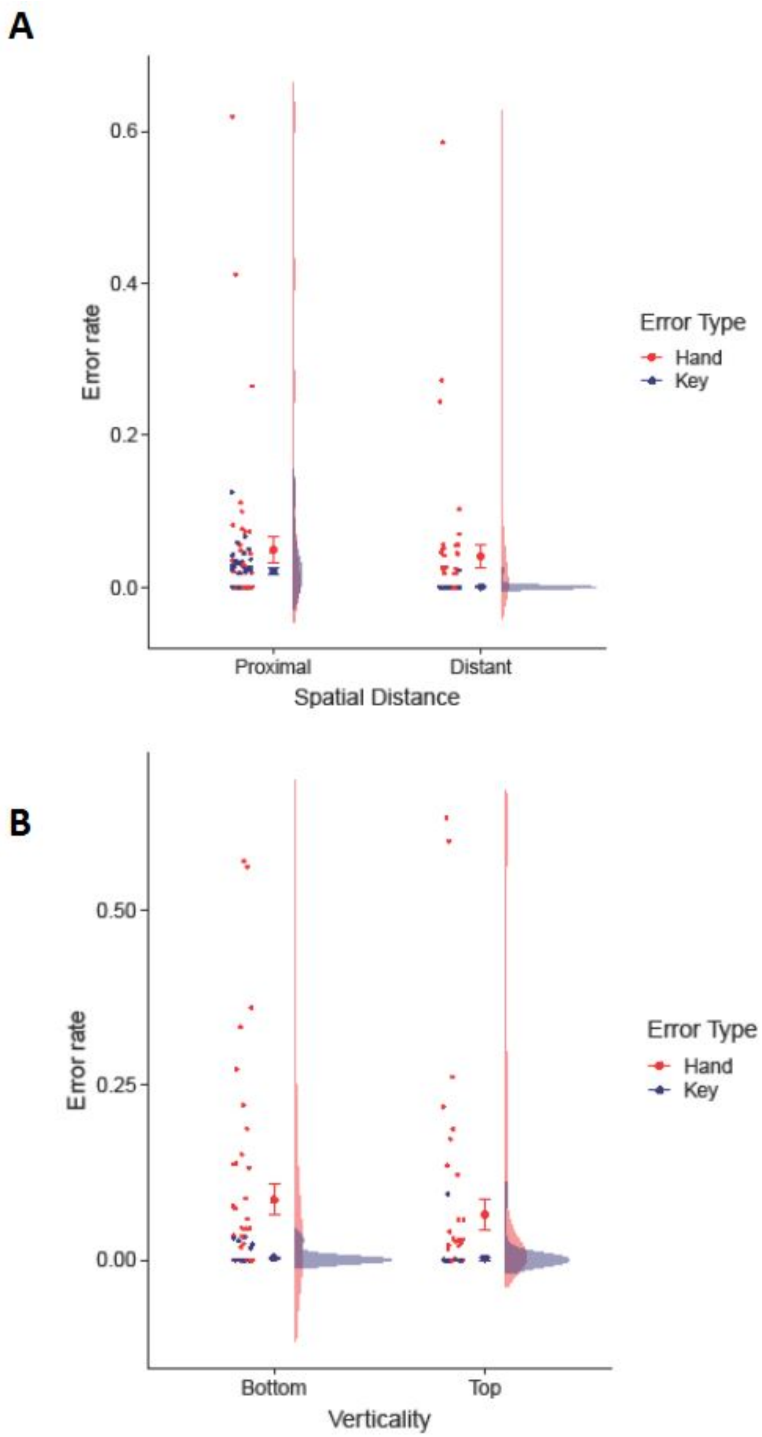

Figure 5. Panel A depicts the error rate in speeded imitation as a function of error type (hand, key) and spatial distance (proximal, distant). Panel B depicts the error rate in speeded imitation as a function of error type (hand, key) and veridicality (bottom, top). Error bars indicate standard errors.

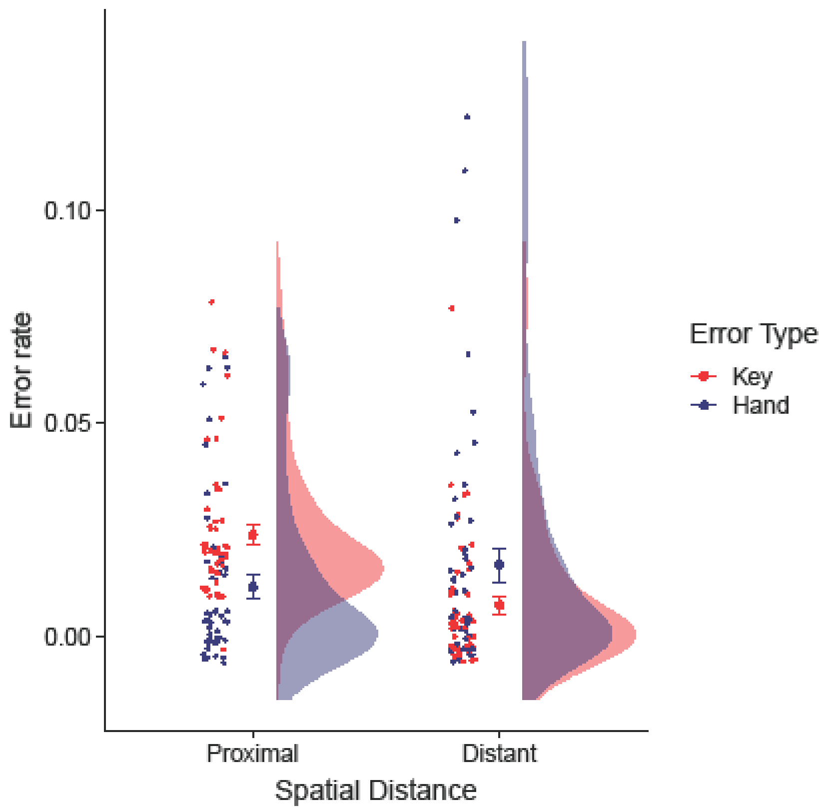

Figure 6. The error rate in recognition as a function of error type (hand, key) and spatial distance (proximal, distant) in Experiment 4. Error bars indicate standard errors.