

# The Antecedents and Consequences of Human Behavioral Mimicry

Tanya L. Chartrand<sup>1</sup> and Jessica L. Lakin<sup>2</sup>

<sup>1</sup>Fuqua School of Business, Duke University, Durham, North Carolina 27708, <sup>2</sup>Department of Psychology, Drew University, Madison, New Jersey 07940; email: TLC10@duke.edu, JLakin@drew.edu

Annu. Rev. Psychol. 2013. 64:285–308

First published online as a Review in Advance on September 27, 2012

The *Annual Review of Psychology* is online at [psych.annualreviews.org](http://psych.annualreviews.org)

This article's doi:  
10.1146/annurev-psych-113011-143754

Copyright © 2013 by Annual Reviews.  
All rights reserved

## Keywords

imitation, automaticity, nonconscious processes, nonverbal behavior

## Abstract

Behavioral mimicry—the automatic imitation of gestures, postures, mannerisms, and other motor movements—is pervasive in human interactions. The current review focuses on two recent themes in the mimicry literature. First, an analysis of the moderators of mimicry uncovers the various motivational, social, emotional, and personality factors that lead to more or less mimicry of an interaction partner in a given situation. Second, a significant amount of recent research has identified important downstream consequences of mimicking or being mimicked by another person. These include not only increased prosociality between interactants, but also unexpected effects on the individual, such as cognitive processing style, attitudes, consumer preferences, self-regulatory ability, and academic performance. Behavioral mimicry is also placed in its broader context: a form of interpersonal coordination. It is compared to interactional synchrony and other social contagion effects, including verbal, goal, and emotional contagion and attitudinal convergence.

## Contents

INTRODUCTION .....	286
DEFINITION AND TYPES OF BEHAVIORAL MIMICRY .....	286
EARLY WORK ON BEHAVIORAL MIMICRY .....	287
THE MODERATORS: WHO, WHEN, WHERE, AND HOW MUCH DO PEOPLE MIMIC? ....	288
Facilitators .....	288
Inhibitors .....	290
THE CONSEQUENCES: WHAT IMPACT DOES MIMICRY HAVE ON INDIVIDUALS AND THEIR RELATIONSHIPS WITH OTHERS? .....	291
Consequences for the Individual ....	291
Social Consequences .....	293
RELATIONSHIP BETWEEN BEHAVIORAL MIMICRY AND INTERACTIONAL SYNCHRONY .....	296
RELATIONSHIP BETWEEN BEHAVIORAL MIMICRY AND OTHER TYPES OF SOCIAL CONTAGION .....	297
Verbal Mimicry .....	297
Emotional Contagion .....	298
Goal Contagion .....	298
Attitudinal Mimicry .....	299
FUTURE DIRECTIONS .....	299
CONCLUSION .....	300

## INTRODUCTION

The ubiquity of human mimicry has long been of interest to researchers in fields such as social psychology, communication, clinical psychology, neuroscience, developmental psychology, and consumer behavior. People mimic virtually everything they observe in others, including their motor movements and behaviors (e.g., gestures, mannerisms, postures). This behavioral mimicry can occur automatically, without conscious awareness or intent to imitate. Due to the proliferation of

studies on behavioral mimicry in recent years, an exhaustive review is beyond the scope of this article. Instead, we highlight the key findings in the field and focus on two major questions. (a) What causes more or less mimicry to occur in a given social interaction? (b) What are the downstream consequences of such mimicry occurring, both for the individual and for the dyad? The review is organized as follows. First, we define behavioral mimicry and describe the various types that have been identified. Next, we give a brief historical survey of behavioral mimicry research, describing the initial demonstrations and findings, followed by an in-depth discussion of the moderators and downstream consequences of mimicry. Finally, we place this literature in the broader context of interpersonal coordination, comparing the behavioral mimicry findings to what has been found thus far in the interactional synchrony literature and other literatures related to social contagion.

## DEFINITION AND TYPES OF BEHAVIORAL MIMICRY

We first define the terms we will be using. Behavioral mimicry occurs when two or more people engage in the same behavior at the same time. This includes mimicry of mannerisms, gestures, postures, and other motor movements. It is commonly assessed by verifying that people are engaging in the same (or a similar) action at a certain time, or that a particular behavior is repeated by an interaction partner within a short window of time, typically no longer than three to five seconds. Research on behavioral mimicry has examined a variety of motor movements, including yawning (Helt et al. 2010, Provine 1986), body posture (La France 1982, Tia et al. 2011, Tiedens & Fragale 2003), face touching (Chartrand & Bargh 1999, Lakin & Chartrand 2003, Stel et al. 2010b, Yabar et al. 2006), foot shaking (Chartrand & Bargh 1999, Lakin et al. 2008), food consumption (Herrmann et al. 2011, Johnston 2002, Tanner et al. 2008), pen playing (Stel et al. 2010b, van Baaren et al. 2006), coloring (van Leeuwen et al. 2009b), handshake angle and speed (Bailenson & Yee 2007),

cospeech gestures (Goldin-Meadow & Alibali 2013, Holler & Wilkin 2011), and a variety of health-related behaviors (e.g., smoking, Harakeh et al. 2007; taking the stairs rather than an escalator, Webb et al. 2011; eating, Hermans et al. 2012). Other research has looked at micro movements, such as finger tapping (van Leeuwen et al. 2009a), and has even tested impossible movements, like a finger movement that appears to cross a physical barrier (Liepelt & Brass 2010).

Recently, Heyes (2011) has argued that stimulus compatibility effects (e.g., quicker response times when opening a hand when someone else opens her hand, as opposed to when she closes her hand; Brass et al. 2001, Leighton et al. 2010) should also be classified as automatic imitation. She suggests that behavioral mimicry is simply a temporal facilitation of a congruent behavioral response compared to an incongruent behavioral response. Stimulus compatibility measures are quite different from other measures of imitation; time is the dependent variable instead of behavior and, unlike other measures of behavioral mimicry, there is a correct response to be given after a stimulus is presented. Will stimulus compatibility measures share the same precursors and consequences as other behavioral mimicry measures? Though there is some evidence to suggest this will be the case (Leighton et al. 2010), it is still quite early.

Mimicry can manifest in other ways as well. People mimic facial expressions (Bavelas et al. 1986, Dimberg et al. 2000, Lundqvist & Dimberg 1995) and emotional reactions (Hatfield et al. 1994, 2009; Hawk et al. 2011; Huntsinger et al. 2009; Neumann & Strack 2000) of interaction partners, often beginning at an extremely young age (Meltzoff & Moore 1983, Termine & Izard 1988). In addition, people mimic verbal characteristics of interaction partners, including accents (Giles et al. 1991), linguistic style (Ireland & Pennebaker 2010, Niederhoffer & Pennebaker 2002), speech rate (Webb 1969), and syntax (Levelt & Kelter 1982). It could be argued that these are, to some extent, behavioral phenomena, but the current review largely focuses on mimicry of gross mo-

tor movements. We return to the relationship between behavioral mimicry and other types of social contagion at the end of this review.

Finally, one may ask whether this type of interpersonal coordination is deliberately and consciously engaged in or not (Lakin 2006). Although people intentionally imitate each other all the time, and this is an important component of social learning (Bandura 1977), the mimicry of gross and fine motor movements (e.g., gestures, mannerisms, finger movements), facial expressions, and vocalizations is often nonconscious, unintentional, and effortless. In fact, people often feel it is uncontrollable and are embarrassed when it is pointed out to them (Chartrand et al. 2005, White & Argo 2011). It is this automatic mimicry that we focus on in this review.

## EARLY WORK ON BEHAVIORAL MIMICRY

There are several detailed and relatively recent literature reviews focusing on behavioral mimicry (Chartrand & Dalton 2009, Chartrand & van Baaren 2009, van Baaren et al. 2009), but in this article we will offer a brief historical survey in order to provide a context for the most recent discoveries. The early studies of behavioral mimicry chiefly focused on interactions between people who knew one another, such as children and parents (Bernieri et al. 1988), clients and therapists (Charney 1966, Maurer & Tindall 1983, Schefflen 1964), and students and teachers (Bernieri 1988, La France 1979, La France & Broadbent 1976). Behavioral matching was exhibited among all of these groups, often increasing as the duration of contact increased (e.g., Charney 1966).

Though some recent research has continued to explore behavioral mimicry between familiar interactants (e.g., Jones 2007), most has focused upon that which occurs between strangers. Chartrand & Bargh (1999) demonstrated that participants engaged in more foot shaking when with a foot-shaking than face-touching confederate, and more face touching when with a face-touching than

foot-shaking confederate. Behavioral mimicry occurred despite the fact that (*a*) the participant and confederates did not know one another, (*b*) welcoming or affiliative behaviors were not performed by the confederates, and (*c*) participants were later unable to recall the confederates' behaviors and the change in their own behaviors. This phenomenon was coined "the chameleon effect" because, much like chameleons change their color to blend into the surrounding environment, humans alter their behavior to blend into social environments (see also Chartrand et al. 2005 and Lakin et al. 2003). Following this initial laboratory demonstration, research turned to uncovering the moderators and consequences of this chameleon-like behavior.

### THE MODERATORS: WHO, WHEN, WHERE, AND HOW MUCH DO PEOPLE MIMIC?

Though behavioral mimicry is ubiquitous and engaged in automatically, various features of the social environment and the individuals involved render a person even more susceptible to chameleon-like behaviors.

#### Facilitators

**Pre-existing rapport.** When considering the connection between behavioral mimicry and rapport (Tickle-Degnen 2006), it is not surprising that behavioral mimicry increases when one has pre-existing rapport with an interaction partner. Participants mimic friends more than strangers and likeable confederates more than unlikeable confederates (McIntosh 2006; see also Likowski et al. 2008). Stel et al. (2010b) manipulated participants' prior opinions of a confederate by presenting him as either honest and open or dishonest and detached, and effectively replicated the results of McIntosh's earlier study: Participants were more likely to mimic face touching or pen playing with a likeable confederate than with a dislikable confederate. Similarly, Yabar et al. (2006) and Bourgeois & Hess (2008) found evidence that members of an ingroup are mimicked more than people who belong to an outgroup. Even

incidental similarities such as sharing the same first name leads to more mimicry (Guéguen & Martin 2009).

**Goal to affiliate.** The mere desire to affiliate or create rapport also leads to more behavioral mimicry. Lakin & Chartrand (2003) gave participants either a conscious or unconscious affiliation goal (or no goal) and recorded their behavior while watching a videotaped confederate touch her face subtly and consistently. For the conscious affiliation goal condition, participants were told that they would be interacting with another person in order to complete a task, and it would be beneficial for the task if they got along well; in the unconscious goal condition, participants were subliminally primed using affiliative words (e.g., affiliate, friend, together). Both groups—regardless of the source of the goal—engaged in more face-touching behaviors than did participants in a control no-goal condition. Those with a conscious goal and an unconscious goal showed the same amount of behavioral mimicry.

Leighton et al. (2010) recently generalized this finding to a stimulus compatibility measure of behavioral mimicry by priming participants with prosocial words (similar to those used by Lakin & Chartrand 2003) or antisocial words (e.g., rebel, alone, single) and then asking them to complete a stimulus compatibility task. Participants performed a particular hand-opening or hand-closing action while observing a hand open or close on a computer screen, and reaction times for movement initiation were recorded. The authors posited that automatic behavioral mimicry occurs to the extent that participants move faster when watching a congruent movement than an incongruent one (Heyes 2011). Automatic imitation was greater when participants were primed with prosocial, affiliative words than with antisocial words (for an exception, see Cook & Bird 2011).

There is also evidence that features of the environment that should trigger an affiliation goal in daily life also lead to more mimicry. For instance, Lakin & Chartrand (2003) demonstrated that an unfulfilled affiliation

goal—for example, a primed affiliation goal that could not be pursued initially due to the unfriendliness of a confederate—led to increased levels of behavioral mimicry with a new interaction partner. In another set of studies, Cheng & Chartrand (2003) found that high self-monitors—who alter their behavior as a result of affiliative social clues—mimic peers more than nonpeers and the powerful more than the powerless (and mimic more than low self-monitors in either situation; see also Estow et al. 2007). Lakin et al. (2008; see also Lakin & Chartrand 2005, 2012; Over & Carpenter 2009) identified exclusion as a trigger of an affiliative motivation and found that those who had recently experienced social exclusion were especially motivated to affiliate through behavioral mimicry of a subsequent interaction partner. People were selective in whom they mimicked after an exclusion experience; their mimicry of a confederate increased when (*a*) the participant had been excluded by ingroup members and (*b*) the confederate was a member of that ingroup (representing an opportunity to “regain status” within that ingroup). Collectively, these results support a positive correlation between the desire to affiliate—even if it is more acute in certain individuals or groups than others—and an increase in behavioral mimicry.

**Individual differences in prosocial orientation.** There are also individual differences that impact the amount of behavioral mimicry in which people engage. Some of these variables are loosely related to prosociality (i.e., an increased interest in understanding and relating to others). One example of such a variable is dispositional empathy. Specifically, individuals high in perspective taking mimic an interaction partner more than those who are low in perspective taking (Chartrand & Bargh 1999). Later research extended this to mimicry of facial muscles, with high-empathy participants more likely to mimic both happy and angry expressions, even if exposure to those expressions was short (Sonnby-Borgström 2002; see also Sonnby-Borgström et al. 2003).

People possessing an interdependent self-construal focus on the self as it relates to others relative to those who have a more independent self-construal (Markus & Kitayama 1991). As such, van Baaren et al. (2003b) proposed that those with an interdependent self-construal (either temporarily active through priming or chronically active through cultural transmission) would exhibit more mimicry. Their results supported the hypothesis, as participants were more likely to mimic a confederate’s pen-playing behaviors when primed with an interdependent self. Japanese participants were also more likely to mimic the face touching of a confederate than were American participants, regardless of that confederate’s ethnicity. A field-dependent cognitive processing style (i.e., where objects are perceived within their context) yielded similar results; both chronic and primed field dependence both resulted in more mimicry than dispositional or situational field independence (van Baaren et al. 2004b).

**Similarity.** Van Swol & Drury (2006) have examined whether people mimic others more if those others have similar opinions to their own. They found that shared opinions in fact moderate mimicry, such that people engage in more mimicry of a confederate who expresses agreement with them on various viewpoints relative to a confederate who expresses disagreement. Another form of similarity is shared knowledge, and stereotypes can be conceptualized as one form of shared knowledge. As a result, Clark & Kashima (2007) argued that we should mimic another person more if that person expresses stereotypes (thus signaling similarity). Supporting this, Castelli et al. (2009) found that people mimic others who are stereotyping more than those who are not currently stereotyping.

In addition, the amount of mimicry observed also varies as a function of the number of actors who are both observing and producing the behavior. Tsai et al. (2011) predicted that groups would tend to mimic the behaviors of groups more than the behaviors of individuals, presumably due to greater similarity and perceived “appropriateness.” They employed a

stimulus compatibility measure similar to that used in Leighton et al. (2010), also adding a numerical compatibility manipulation. Participants performed two types of tasks with a confederate: numerically compatible (participants watched two actors perform a behavior in which both participant and confederate then had to engage) or numerically incompatible (participants watched two actors perform a behavior, and the participant alone engaged in said behavior). The results confirmed the hypothesis; groups responded faster with mimicry behavior of other groups, and individuals responded faster with mimicry behavior of single individuals. In short, groups tend to mimic other groups, whereas individuals mimic other individuals.

**Mood and emotion.** One's current mood and emotional state have also been found to affect behavioral mimicry. van Baaren et al. (2006) induced either a positive or a negative mood in participants with media clips. Afterward, participants watched two experimenters: one who played with a pen and one who did not. The participants in a positive mood mimicked the pen playing more than those in a negative mood. Recently, Likowski et al. (2011) replicated these findings: Happy participants mimicked happy, sad, neutral, and angry facial expressions more than unhappy participants. Although social anxiety is a more chronic form of negative affect, it relates to behavioral mimicry in a similar way; women with high social anxiety are less likely to mimic the head movements of a computerized avatar delivering a speech than are women with lower levels of social anxiety (Vrijnsen et al. 2010a).

There is, however, one negative emotion that can actually lead to more mimicry: guilt. Martin et al. (2010) instructed a confederate carrying a stack of papers and other items to exit her office and bump into participants, who were walking down a long narrow hallway. To induce guilt, the confederate blamed the collision on the participant; in conditions inducing no guilt, the confederate took the blame herself. Later, the participants were unobtrusively filmed while watching a recording of a

young woman touching her face. The guilty participants exhibited more mimicry, and this was moderated by the degree of guilt felt, with the participants who were not able to make amends (i.e., the confederate left immediately after laying blame) displaying the highest levels of mimicry, presumably in order to forge affiliation in light of their earlier "transgression."

**Executive functioning.** Research continues to support the notion that behavioral mimicry is the default in most social interactions, occurring even when people are cognitively occupied with other tasks. Van Leeuwen et al. (2009a) had participants perform a finger movement when prompted with either a movement or a spatial cue (i.e., "X") on a screen, half while under working memory load and the other half not. Participants were quicker to respond to the finger movement than the spatial cue, but only when they were under cognitive load; that is, behavioral mimicry increased under cognitive load.

## Inhibitors

Less work has focused on inhibitors of mimicry, but some attenuating factors have been found. These are reviewed next.

**Goal to disaffiliate.** Johnston (2002) found that people mimic less when they do not want to affiliate with another person. Specifically, participants mimicked the ice cream consumption of a confederate less if that confederate was stigmatized in some way (e.g., obese, facial scar). Another variable leading to less mimicry is outgroup status. Yabar et al. (2006) found that non-Christian female participants mimicked the face-touching behavior of openly Christian confederates less than confederates not identified as being from any particular religion. Subsequent studies revealed the underlying mechanism to be a lack of liking. Similarly, Stel et al. (2008) found that when a target is disliked, facial mimicry is attenuated. They also found that the more negative a participant's implicit attitude was toward a racial outgroup, the



less someone of that outgroup was mimicked. Thus, when people want to disaffiliate with others, they automatically mimic those others less.

Another variable that may reduce the amount of mimicry in which people engage is one's relationship status. Given the connections between mimicry, rapport, and affiliation, people tend to mimic the behaviors of attractive people—regardless of gender (van Leeuwen et al. 2009b)—to a greater extent. In other words, behavioral mimicry is one potential method of communicating romantic interest (Guéguen 2009, van Straaten et al. 2008). As demonstrated by Karremans & Verwijmeren (2008), however, relationship status moderates these tendencies. Male and female participants who were either in a relationship or not interacted with attractive confederates of the opposite sex for four minutes, during which the confederates rubbed their faces. Participants in a relationship showed lower levels of mimicry than did single participants, and for participants in close committed relationships, levels were lower still. By avoiding mimicry of the attractive, alternative partner, participants appeared to be protecting or shielding their current relationships. In another intriguing use of mimicry inhibition to shield and maintain relationships, people do not mimic the angry facial expressions of their partners (particularly if they are in communal relationships with them), but rather respond spontaneously with a smile. This doesn't hold true for strangers, however; people do mimic their angry expressions (Häfner & IJzerman 2011).

## THE CONSEQUENCES: WHAT IMPACT DOES MIMICRY HAVE ON INDIVIDUALS AND THEIR RELATIONSHIPS WITH OTHERS?

The previous section focused on the moderators of mimicry: What individual or situational factors lead one to mimic more or less in a given social interaction? Once mimicry occurs, there are both individual and social consequences. People who are mimicked by others become more prosocial, and this is expressed in many

ways, both toward the mimicker and beyond the dyad. People who are mimicked also experience outcomes unrelated to prosociality, and it is to these individual consequences that we turn first.

## Consequences for the Individual

**Cognitive processing.** Being mimicked has the power to change the way that people think in a number of ways. As van Baaren et al. (2004b) demonstrated, mimicry is more likely to occur when one is field dependent, but the reverse is also true: When participants are mimicked (compared to when they are not) they become more field dependent and thus are able to better recall object positions in a complex memory task. This phenomenon has been replicated conceptually with a more assimilative mindset; participants who are mimicked notice more similarities when shown two loosely related images (van Baaren et al. 2009).

Leander et al. (2011a) hypothesized that the assimilative mindset resulting from mimicry might have another consequence. Specifically, they theorized that mimicked individuals might be more likely to conform to stereotypic expectancies. They found that women and African American men who were mimicked (versus not mimicked) performed worse on a math test than did members of groups not stereotypically associated with poor math performance. When participants believed that others held stereotypic expectancies of them, this effect was more pronounced.

Mimicry (or the lack thereof) also serves as a cue for different types of creative thinking. Being mimicked stimulates convergent thinking, whereas not being mimicked leads to an increase in divergent thinking (Ashton-James & Chartrand 2009). Finally, behavioral mimicry affects self-focus; both private and public self-consciousness increase after one is mimicked (Guéguen 2011).

**Persuasion and consumer behavior.** Another consequence of behavioral mimicry is an increase in persuasion and subsequent changes in consumer behavior and product preferences.

Van Swol (2003) had a confederate, while trying to change the participant's opinion on a topic, imitate his or her behaviors (or not). Later, participants reported that they perceived the mimicking confederate as more knowledgeable and persuasive, even though they did not ultimately change their opinion on the topics. In a twist on this, Bailenson & Yee (2005) found that participants liked a computer avatar that mimicked their head movements more than one that didn't, and were more persuaded by its arguments.

If mimicry affects persuasiveness, it should also affect subsequent consumer preferences and behavior. When introducing a new sports drink to participants, Tanner et al. (2008) had confederates mimic their behaviors (or not); those who were mimicked enjoyed the product more and stated a higher likelihood of purchasing it than did those who were not mimicked. In a later study, this effect proved to be stronger when the facilitator expressed open investment in the product. Recently, this phenomenon was replicated in an applied context by Jacob et al. (2011; see also Herrmann et al. 2011). Salespeople mimicked both verbal and nonverbal behaviors of their patrons; customers were then more likely to buy a product, especially those recommended by the sales clerk, and clerk and store both received better evaluations. In fact, these effects were not limited to the person being mimicked. Participants expressed opinions that were more favorable after mimicking the behaviors of a model displaying a product on a television commercial, and showed stronger intent to purchase (Stel et al. 2011a; see also Tanner et al. 2008).

**Self-regulatory ability.** Given how much mimicry we encounter in our daily lives, it would be adaptive to develop "expectations" or schemas for how much mimicry there typically is in a given type of social interaction. Dalton et al. (2010) argued that just as people organize relevant information about interacting with others into schemas, they might also incorporate (implicitly) learned information and rules concerning mimicry into schemas that can

be (unconsciously) deployed when necessary. They posited implicit mimicry schemas, which essentially are unconsciously held expectations for levels of mimicry. Moreover, when those expectations are violated, they suggested that self-regulatory ability and self-control should be diminished (i.e., people should be "depleted"). Finkel et al. (2006) found that people who were mimicked did better on a fine-motor control task than did people who were not mimicked. Dalton et al. (2010) replicated this difference for a very different self-control task: eating junk food. Specifically, those who were mimicked ate less junk food than did people who were not mimicked. Dalton et al. (2010) further found that it was the conditions in which there was no mimicry that were driving these effects. Compared to participants who had been mimicked or who interacted with another person through a divider, participants who had not been mimicked at all procrastinated more on an upcoming math task. This suggests that it is not the case that being mimicked repletes resources; rather, not being mimicked depletes resources (when there is an expectation of some default amount of mimicry).

The previous studies are consistent with two different explanations: a lack of mimicry in itself being depleting, and a violation of implicit expectations for mimicry being depleting. To test these competing accounts, Dalton et al. examined a situation in which there is typically not a lot of mimicry: cross-race interactions (J.D. Heider and J.J. Skowronski, unpublished manuscript., Dep. Psychol., Stephen F. Austin State Univ., Nacogdoches, Texas).

If it is simply not being mimicked that leads to self-regulatory depletion, then not being mimicked by someone of a different race should lead to more depletion. If, however, it is the violation of implicit expectations that leads to the depletion, then the presence of a lot of mimicry in a cross-race interaction should lead to more depletion. The results supported the latter account. The authors also found a similar pattern with power differences; people who were mimicked by someone who had power over them (which presumably violated implicit



expectations) showed worse performance on a Stroop task than did those who were not mimicked, while the reverse was true for those who were mimicked by someone over whom they had power.

**Extension to embodied cognition.** Leander and colleagues (2012) recently extended the notion of implicit schemas for mimicry into the embodiment domain. Previous research has found that mimicry can elicit feelings of disliking and threat if applied to the wrong person or situation (Liu et al. 2011, Stel et al. 2010a). Thus, Leander et al. (2012) argued that an inappropriate amount of behavioral mimicry (either too much or too little) might serve as a basic cue to suspicion; it might signal social coldness or that something is “off,” which could lead to physical feelings of chill or coldness (Bargh & Shalev 2012, Zhong & Leonardelli 2008). Across several studies, the authors found that being mimicked either more or less than implicitly anticipated led people to feel colder and guess the current temperature of a room to be colder.

## Social Consequences

The previous review suggests that mimicry has many important consequences for the individual, including cognitive processing style, performance on tests of ability, creativity, preferences in consumer products, self-control and self-regulatory ability, and physical feelings of coldness. However, there are also consequences of mimicry that go beyond the individual; these are the prosocial consequences. Mimicry creates liking, empathy, and affiliation between interactants. It has been called the “social glue” that brings people together and bonds them (Lakin et al. 2003).

**Liking and empathy.** As evidenced earlier in the review, many of the factors that increase behavioral mimicry are related in some way to affiliation and rapport. It is perhaps not surprising then that one of the most robust and early findings in the mimicry literature was the

impact it has on prosociality. Most of the early work was correlational, revealing a strong positive association between shared postures and self-reported rapport. For example, an increase in rapport between a patient and therapist corresponded with increased postural mimicry on behalf of the patient (Charney 1966; see also Schefflen 1964); similarly, classrooms in which teachers and students shared behaviors, like posture or arm positioning, also expressed higher levels of rapport (Bernieri 1988, La France & Broadbent 1976). In fact, Bavelas et al. (1986) have argued that mimicry serves a communicative function because mimicry of pained expressions is more likely when eye contact is made; this suggests that feelings are being shared and understood between interaction partners, which is characteristic of empathy (for recent replications of how eye contact affects mimicry, see also Holler & Wilkin 2011, Ramanathan & McGill 2008, and Wang et al. 2010).

Chartrand & Bargh (1999) investigated one causal direction between mimicry and liking by directing a confederate to either mimic or not mimic participants’ behaviors. The mimicked participants reported that they liked the confederate more and expressed that the interaction went more smoothly (see also Lakin & Chartrand 2003). Given that bonding between people is important and mimicry increases these bonds, mimicry can be an important tool for people to use when feeling excluded (Lakin et al. 2008). In fact, Kouzakova et al. (2010b) recently demonstrated that low levels of mimicry during an encounter increase cortisol levels, as the body reacts with stress to the implication of rejection. Research has also found that people evaluate their close relationship partners more favorably if they have just had a mimicry-free interaction with a stranger, in theory because that lack of mimicry is akin to mild social exclusion (Kouzakova et al. 2010a).

Behavioral mimicry also leads to feelings of empathy. Maurer & Tindall (1983) established that adolescents found their counselors to be more empathic when mimicked by them, and Stel & Vonk (2010) found that mimicry

triggers both affective and cognitive empathetic reactions. It also attenuates typical “belief in a just world” findings and reduces the blaming of innocent victims (Stel et al. 2012). However, the extent to which mimicry leads to empathy depends on how genuine one deems the mimicked emotions. Stel & Vonk (2009) instructed participants to mimic angry and sad expressions as modeled by a popular television character, and although all participants reported feeling the same emotions while mimicking, only the participants who felt the emotions were “real” reported that they were able to assume that character’s perspective.

The effects of mimicry on liking were recently replicated in an applied context by Sanchez-Burks et al. (2009). Confederates interviewed Latino and Anglo managers and professionals while either mimicking or not mimicking their behaviors; measures of anxiety and interview performance were collected afterward. Objective analysis of measures including variables such as body language and interpersonal skills revealed that interview performance was better and anxiety lower when participants were mimicked. However, this effect was strongest among the Latino participants, presumably because they were more culturally sensitive to interpersonal cues.

Liking and empathy are not only affected by being mimicked; the mimicker often reports affective benefits from the experience as well. Participants who were instructed to mimic their interaction partner’s behaviors reported feeling closer to the mimickee and in general experienced a smoother interaction than did the participants told not to mimic (Stel & Vonk 2010).

### **When mimicry does not lead to liking.**

However, increasing amounts of behavioral mimicry do not always lead to more liking between interaction partners. Specifically, mimicking a disliked person or member of a disliked group does not engender rapport. For instance, Stel et al. (2010a) instructed people to mimic the behaviors of a disliked interaction partner and found that mimicry did not lead to increased liking. Similarly, mimicking outgroup

members does not lead to more liking (van der Schalk et al. 2011). Mimicry also does not increase liking when one has to mimic a nonaffiliative expression (i.e., anger; van der Velde et al. 2010). Furthermore, mimicry is not as directly associated with liking when people possess a proself mindset (as opposed to a prosocial mindset; Stel et al. 2011b), have dispositionally high levels of social anxiety (Vrijnsen et al. 2010b), or are reminded of money (Liu et al. 2011).

It turns out that one does need to mimic the “right” people to enjoy the positive consequences of mimicry. Recent research has found that mimicking may backfire (in terms of public opinion about one’s social competence) if someone mimics an unfriendly person. After watching someone mimicking unfriendly behaviors, people thought the mimicker was less socially competent than someone who mimicked a friendly partner or someone who mimicked no one (Kavanagh et al. 2011).

**Helping behavior.** Prosociality can manifest in several ways. One is a positive emotional response to the mimicker. Another is a behavioral response: helping the mimicker. In fact, mimicry often leads to displays of helpful behaviors directed both toward the person who did the mimicking and toward others more generally. Customers with servers who verbally mimicked their orders left bigger tips than those whose orders were not repeated verbatim (van Baaren et al. 2003a). In another study, participants were more likely to pick up pens dropped by an experimenter (the mimicker) or by a fellow participant (unrelated to the mimicking) when their nonverbal behaviors had been mimicked (van Baaren et al. 2004a). This latter finding suggests that mimicry leads to a more general prosocial orientation, as the helping behavior extends beyond the mimicry dyad. Supporting this, subsequent findings suggest that mimicry also makes people more likely to donate money to charitable causes (Stel et al. 2008, van Baaren et al. 2004a), help a stranded person (Fischer-Lokou et al. 2011), volunteer to fill out a tedious survey (Ashton-James et al. 2007), and complete a long, critical essay (Guéguen

et al. 2011). These effects seem to be influenced by feelings of empathetic concern and extend to the mimickers as well (Stel et al. 2008).

### **Interdependence and feelings of closeness.**

A general prosocial orientation should not only entail increased liking and helping, but also a change in the way one sees oneself, or self-construal. Supporting this, mimicry has been found to increase interdependent self-construals (van Baaren et al. 2003b). In another study, after being mimicked participants expressed more interdependent self-descriptors when completing the Twenty Statements Test, reported feeling closer to others, and chose to sit closer to another hypothetical participant whose belongings were left on a chair (Ashton-James et al. 2007). Mimickers have also reported feelings of increased interdependence (Redeker et al. 2011). This change in self-construal and prosocial orientation can have significant consequences: Participants who are mimicked show more support for liberal political ideas and groups (an effect mediated by prosocial feelings toward others; Stel & Harinck 2011).

Trust between interaction partners is another way of operationalizing feelings of closeness. Trusting behaviors tend to increase after a person has been mimicked. For example, mimicked participants seem more willing than those who were not mimicked to divulge personal information to strangers, even when that information could be embarrassing (Guéguen et al. 2012). According to Maddux et al. (2008), mimicry also smoothes the progress of negotiations. They instructed negotiators to either mimic or not mimic partners' behavior and later assessed mimicry's impact on negotiation outcomes. Mimickers experienced higher individual and dyadic gains and were more willing to come to an agreement with others regarding a difficult decision, and the relationship was mediated by interpersonal trust (see also Swaab et al. 2011).

**Accuracy in emotion perception.** Due to the link between mimicry and empathy, it is

not surprising that behavioral mimicry can lead to more accuracy in understanding the emotions of others. Compared to participants who were told to keep their shoulders still, those told to avoid making any facial movements while viewing photographs capturing certain emotions were slower to identify those emotions (Stel & van Knippenberg 2008; see also Oberman et al. 2007). Moreover, affective judgments are influenced by affective cues only if those cues can be mimicked (Foroni & Semin 2011). Recent research has found that when participants are unable to mimic the facial expressions of others (e.g., through getting Botox injections that paralyze facial muscles), they are less accurate at identifying the emotions other people are experiencing (Neal & Chartrand 2011). However, Stel et al. (2009) uncovered a negative consequence of the mimicry-empathy connection from the mimicker's perspective. Compared to people who don't mimic, mimickers have more trouble discerning when an interaction partner is lying, likely because mimicry interferes with objectivity, making it difficult to identify genuine emotions (for more on this, see Maringer et al. 2011).

**Reducing prejudice.** Another consequence resulting from the link between behavioral mimicry and empathy is a reduction in prejudiced thinking. Inzlicht et al. (2012) had participants watch a video in which a member of an ingroup or outgroup reached for a glass and drank water repeatedly; they were then asked to either mimic the behaviors of the confederate or not before completing measures of both implicit and explicit prejudice. The results showed that levels of both implicit and explicit prejudice went down when the participant mimicked an outgroup member compared to an ingroup member. Thus, although people may be generally less likely to mimic outgroup behaviors (Dalton et al. 2010; J.D. Heider and J.J. Skowronski, unpublished manuscript., Dep. Psychol., Stephen F. Austin State Univ., Nacogdoches, Texas), when they do, it can lead to a reduction in bias.

## RELATIONSHIP BETWEEN BEHAVIORAL MIMICRY AND INTERACTIONAL SYNCHRONY

Research on behavioral mimicry is best understood within the larger context of research on interpersonal coordination. Interpersonal coordination refers to the fact that behaviors in social interactions are often patterned and synchronized; they are similar or identical in form, or they occur at roughly or exactly the same time (Bernieri & Rosenthal 1991, Lakin 2012). These two facets of interpersonal coordination loosely reflect the differences between behavioral mimicry and interactional synchrony. Whereas behavioral mimicry always yields behaviors that are similar in form and close in timing, interactional synchrony may or may not yield behaviors that are similar in form. And although the behaviors of interaction partners occur close in time when observing behavioral mimicry, timing of behaviors is critical to determining whether one person is in sync with others. The complexity of the issue of timing in interactional synchrony cannot be underestimated; because interactional synchrony involves more than one person, it requires anticipation of another person's behaviors so that movement can be coordinated (Knoblich et al. 2011, Marsh et al. 2009, Schmidt & Richardson 2008, Sebanz & Knoblich 2009). However, the evidence to date demonstrates that both the precursors and the consequences of behavioral mimicry and interactional synchrony are often similar (see below), suggesting that both reliably serve the goal of interpersonal coordination more broadly, which is to facilitate and regulate the numerous and complex social interactions people navigate daily (Chartrand & van Baaren 2009, Knoblich & Sebanz 2006, Lakin et al. 2003, Marsh et al. 2009).

A short review of the developing literature on interactional synchrony can illustrate some of the similarities with and differences from the behavioral mimicry literature. Bernieri and his colleagues were the first to experimentally demonstrate that interactional synchrony can be reliably observed in social interactions;

compared to unknown interaction partners, mothers were judged to be more in sync with their own children (Bernieri et al. 1988) and teachers were judged to be more in sync with their own students (Bernieri 1988). Since these initial demonstrations, researchers have explored many phenomena that can be synchronized, such as leg movements when walking (van Ulzen et al. 2008) or sitting (Schmidt et al. 1990), body posture sway when conversing (Shockley et al. 2003, Varlet et al. 2010), eye movements (Richardson & Dale 2005), clapping (Neda et al. 2000), pendulum swinging (Richardson et al. 2005, Schmidt & O'Brien 1997), rocking chair movement (Richardson et al. 2007), waving (Lakens 2010), finger tapping (Oullier et al. 2008), music making (e.g., piano playing; Keller et al. 2007), and dancing (Kirschner & Tomasello 2010).

Subsequent research has also demonstrated, consistent with the earlier work of Bernieri and colleagues, that true therapist-client interactions are more synchronous than pseudointeractions (Ramseyer & Tschacher 2011). Other moderators of interactional synchrony effects are remarkably similar to the moderators of behavioral mimicry effects reviewed earlier; people synchronize more with others with whom they have positive relationships (Julien et al. 2000, Miles et al. 2010a), those with whom they might want to develop positive relationships (Miles et al. 2011), and those with whom they have self-disclosed (Vacharkulksemsuk & Fredrickson 2012). Additionally, people who either dispositionally or temporarily have a prosocial orientation synchronize their behaviors with interaction partners more than people who have a proself orientation (Lumsden et al. 2012).

Not surprisingly, the prosocial consequences of being in sync with an interaction partner are also quite similar to the prosocial consequences of being behaviorally mimicked by an interaction partner. Interpersonal synchrony increases liking: Compared to conditions where participants tapped alone or asynchronously with an experimenter, those who tapped synchronously reported more liking

for the experimenter (Hove & Risen 2009). Conceptual replications have shown that synchronous behavior increases perceptions of similarity, feelings of closeness, and rapport with partners as well (Mazzurega et al. 2011; Paladino et al. 2010; Vacharkulksemsuk & Fredrickson 2012; Valdesolo et al. 2010; Wiltermuth 2012a,b), and can even positively impact the therapeutic process (Ramseyer & Tschacher 2011). Behaving synchronously also promotes cooperation and helping behavior (Kirschner & Tomasello 2010, Valdesolo & DeSteno 2011, Wiltermuth & Heath 2009); increases conformity (Paladino et al. 2010), compliance with a request to aggress (Wiltermuth 2012a), and obedience (Wiltermuth 2012b); improves memory for information provided by and about an interaction partner (Macrae et al. 2008, Miles et al. 2010b); increases pain thresholds (Cohen et al. 2010); and engenders judgments of entitativity (Lakens 2010, Lakens & Stel 2011, Miles et al. 2009). With few exceptions, then, a strong case can be made for the prosociality of interactional synchrony. It remains to be seen if the same consequences for the individual arise from synchrony as well.

There are other similarities between the behavioral mimicry and interactional synchrony literatures. Interpersonal coordination is a skill that would have been important in our evolutionary history, as getting along with others and creating and maintaining social bonds would have been critical for both social and physical survival (Lakin et al. 2003, Rizzolatti & Craighero 2004). Thus, it is not surprising that there may be common neurological underpinnings to behavioral mimicry and interactional synchrony (Hogeveen & Obhi 2011, Obhi et al. 2011). A review of this work is beyond the scope of this article, but suffice it to say, the recent exciting work on mirror neurons has begun to outline the nature of this common biological foundation (interested readers can consult a number of recent reviews for more detailed information: Heyes 2011, Hurley 2008, Iacoboni 2009, Knoblich et al. 2011).

On the other hand, there are some differences between the mimicry and synchrony

literatures, and it is not clear yet the degree to which these differences will be important moving forward. One of the largest differences between work on behavioral mimicry and interactional synchrony has been the focus on timing. The timing of behavior is inherently important when thinking about interactional synchrony, but researchers have focused on this issue much less when thinking about behavioral mimicry (depending on the methodology utilized, some have largely ignored this issue). It is also fair to say that past research on behavioral mimicry has taken a broader view of the phenomenon, focusing heavily on moderators and consequences of our chameleon-like tendencies. The different levels of analysis in each literature have led to correspondingly different levels of information about the specifics of each phenomenon, although to some degree this is changing as interest in the correlates and consequences of interactional synchrony increases.

## RELATIONSHIP BETWEEN BEHAVIORAL MIMICRY AND OTHER TYPES OF SOCIAL CONTAGION

In addition to understanding behavioral mimicry in the context of interpersonal coordination, one can also think about behavioral mimicry as an example of a much broader phenomenon known as social contagion. In other words, mimicry does not occur solely for gross motor behavior: Individuals mimic many different aspects of their social experiences, including other people's verbal behaviors, emotions, goals, and attitudes. Despite the fact that these other types of contagion are often less direct than simply observing a behavior in one's environment and then ultimately producing the same or very similar output, social contagion occurs frequently and unconsciously.

### Verbal Mimicry

Beyond observable behaviors, people also imitate their interaction partners' vocal behaviors, including syntax (Levelt & Kelter 1982),



speech rates (Webb 1969), and accents (Giles et al. 1991). Recent research extended these findings to demonstrate that people also mimic the general linguistic style of others, including number of spoken words and the degree to which different types of words are utilized (e.g., prepositions, past tense verbs, function words; Ireland & Pennebaker 2010, Niederhoffer & Pennebaker 2002).

## Emotional Contagion

Humans often spontaneously read and take on the emotional and affective states of others, a phenomenon known as emotional contagion (Hatfield et al. 1994, 2009). For example, in one demonstration, Neumann & Strack (2000) presented participants with a clip of a neutral speech that was read in either a slightly happy or slightly sad tone. Participants who heard the happy speech reported being in a better mood than participants who heard the sad speech. Additionally, when participants in a separate study repeated the speech that they had heard, objective raters indicated that they mimicked the affective tone of the original speech (i.e., participants who heard the slightly happy speech repeated the speech in a happier tone than participants who heard the slightly sad speech). An actual interaction with others is not even necessary to catch their moods; when people are motivated to affiliate with others, they will match their moods to others in anticipation of those interactions (Huntsinger et al. 2009).

In another set of studies, Lundqvist & Dimberg (1995) exposed participants to visual images of faces expressing several different emotions (e.g., sadness, anger, happiness). In addition to demonstrating that participants mimicked the specific patterns of muscular activity associated with the different emotional expressions (see also Dimberg et al. 2000), participants reported experiencing the related emotion (see also McIntosh 2006). There are moderators to this effect [e.g., people who interpret self-produced emotional cues are more likely to experience emotional contagion from facial expressions (Laird et al. 1994);

women may experience emotional contagion more than men (Sonnby-Borgström et al. 2008)], but it seems reasonable to assume that emotional contagion effects are at least sometimes grounded in people's automatic mimicry of others' facial expressions (although there is debate about this issue; e.g., Hess & Blairy 2001).

## Goal Contagion

People also automatically pursue goals associated with important significant others. That is, goals can be "caught" from others in the same way that verbal characteristics and emotions can be (Fitzsimons & Finkel 2010). In one of several studies, Fitzsimons & Bargh (2003) showed that participants who had a goal to understand their best friend's behaviors made situational attributions for another's behavior when subliminally primed with their best friend's name more than did participants who did not have this goal. Similarly, participants who had a goal to make their mother proud worked harder on a difficult task when primed with their mothers than did participants who did not have this goal associated with their mother. Whereas the Fitzsimons & Bargh (2003) findings suggest that significant others activate goals we often have when we are with those significant others, Shah (2003) found that significant others can also activate goals that they chronically have for us. He also found that these effects are moderated by closeness to the other individual.

These effects are not limited to those with whom we have a close relationship; just witnessing another person's behavior causes people to automatically infer the underlying goal (Hassin et al. 2005) and then adopt and pursue that goal themselves (Aarts et al. 2004). Aarts et al. (2004) coined this "goal contagion" and have found that we even "catch" goals of strangers. Subsequent work on goal contagion has found that it is moderated by consistency with chronic motives, perception of effort, group membership, and goal strength (Aarts et al. 2005, Dik & Aarts 2007, Leander et al. 2011b, Loersch et al. 2008).



## Attitudinal Mimicry

More general attitudes can be caught and shared as well, even when those attitudes are self-relevant. One particularly striking example has been supplied by Sinclair and colleagues. In their studies, participants adopted attitudes similar to those of another person with whom they were interacting, especially if they were motivated to affiliate with that person (Sinclair et al. 2005b). Self-evaluations (i.e., attitudes about the self) and behavior also shifted to be more in accord with the attitudes of others when affiliative motivation was high (Sinclair et al. 2005a). It has been argued that adopting the attitudes of others, even when those attitudes might be personally detrimental or constraining, contributes to the development of a shared reality, which establishes and maintains social bonds (Hardin & Higgins 1996).

## FUTURE DIRECTIONS

This review only begins to explore a few of the questions that still need to be addressed as we move forward in our understanding of these phenomena, as behavioral mimicry, interactional synchrony, and social contagion more generally continue to garner the attention of scholars. There are other questions, however, worthy of future attention beyond those that have already been raised.

First, as evidenced by this review, one issue that will be important to explore in future research is the relationship between interpersonal coordination, as demonstrated by both behavioral mimicry and interactional synchrony, and social contagion more generally. Both behavioral mimicry and interactional synchrony create rapport and smooth social interactions; some social contagion effects accomplish this goal as well. Additionally, all three phenomena seem to occur mostly outside of conscious awareness and without intent. On the other hand, each phenomenon is unique in some ways; behavioral mimicry and interactional synchrony involve fairly direct coordination of visible behavioral output, whereas social contagion rarely deals with output that is physically

observable. Timing plays a critical role in interactional synchrony, whereas it is somewhat less of an issue in behavioral mimicry, and even less of an issue in certain types of social contagion. What is the nature of the relationship between these three phenomena? Are they all examples of the same basic underlying process? Looking at the relationships between these literatures will be complicated by the fact that scholars in many different areas research these topics, and approaches to studying these phenomena vary greatly.

For the behavioral mimicry literature specifically, there are several avenues of investigation that should be particularly fruitful in the next decade or so. For example, the behaviors that have been explored thus far have been reasonably neutral, such as leg crossing and face touching; it remains to be seen if people will mimic valenced behaviors to the same degree. It might be especially important to explore negative behaviors and the consequences of coordination—typically positive—in this negative context. Another question is when mimicry versus complementarity should be observed in the nonverbal behaviors of interaction partners. A difference in status between interactants seems to be one variable that can lead to complementarity rather than mimicry (Tiedens & Fragale 2003), as can relationship status (Häfner & IJzerman 2011). Are there other variables that have similar effects? What is the exact relationship between mimicry and complementarity?

Behavioral mimicry has thus far almost exclusively been examined within the dyad (for an exception, see Tsai et al. 2011). However, future research can explore how mimicry plays out when there are more than two interactants. Examining who tends to be more mimicked within a group might have implications for understanding leadership development or popularity. What mannerisms or gestures tend to be most mimicked? Are there certain personality traits that lead some people to be more mimicked than others? There also has been limited research thus far focusing on the observation of mimicry (or lack thereof) between others.

What kinds of inferences are made about the dynamics of the relationship and about the individuals mimicking more or less than expected?

Finally, antimimicry represents an important direction for future research. Despite sporadic usage of this term, it is not clear exactly how this term should be defined. Consistent with the idea of complementarity, antimimicry might be characterized as performing opposite behaviors (as opposed to just not mimicking), but not all behaviors have clear conceptual opposites; it is also not clear whether engaging in an opposite behavior has consequences that are different from simply not engaging in the behavior. A conceptually related question is whether there can ever be “too much” mimicry (and if so, what the consequences might be). These are rich questions that future research can explore as work on behavioral mimicry continues to deepen.

## CONCLUSION

In sum, behavioral mimicry is a ubiquitous phenomenon that often occurs outside of conscious

awareness and intent. People mimic frequently in most situations, although certain features of the environment or the individuals involved (including their goals, emotions, attitudes, and certain traits) can increase the amount of mimicry in a given interaction. In fact, people seem to “use” mimicry as a (nonconscious) strategy to get others to like them, increasing the frequency of mimicry in a selective manner when they want to affiliate with another person. This turns out to be an effective and adaptive automatic tendency, because as long as it remains unnoticed, mimicry can lead to prosociality between interaction partners, including increased liking, empathy, smoother interactions, and helping behavior. Being mimicked also has consequences for the individual, influencing outcomes as wide-ranging as cognitive style, attitudes and preferences, and self-regulatory ability. Hopefully future generations of researchers will continue to explore behavioral mimicry and illuminate the functions it serves, the mechanisms underlying it, and the role it plays in building and fostering relationships.

### SUMMARY POINTS

1. Behavioral mimicry occurs when two or more people engage in the same behavior at the same time. This includes mimicry of mannerisms, gestures, postures, and other motor movements.
2. Automatic behavioral mimicry has been called the chameleon effect because, much like chameleons change their color to blend into the surrounding environment, humans alter their behavior to blend into social environments.
3. More automatic behavioral mimicry is observed when there is preexisting rapport or a goal to attain such rapport between interactants, when the interactants feel similar to each other, or when one of the interactants is high in prosocial orientation or in a positive mood.
4. Less behavioral mimicry is observed when there is a goal to disaffiliate among interaction partners.
5. There are consequences of behavioral mimicry for individuals being mimicked. Specifically, it impacts the information-processing style they adopt as well as their performance on achievement tasks, creativity, self-control, and consumer preferences and behavior.
6. There are also consequences of behavioral mimicry for social interactions. Individuals who are mimicked manifest greater liking, empathy, helping behavior, closeness and interdependence with others, accuracy in understanding emotions, and reduction in prejudice.

7. Individuals mimic many different aspects of their social experiences as well, including other people's verbal behaviors, emotions, goals, and attitudes. Despite the fact that these other types of social contagion are less direct than behavioral mimicry, they also occur frequently and unconsciously.

## FUTURE ISSUES

1. One issue that will be important to explore in future research is the relationship between behavioral mimicry, interactional synchrony, and social contagion more generally. Are they all examples of the same basic underlying process?
2. Behavioral mimicry has thus far focused on neutral behaviors, such as leg crossing and face touching; it remains to be seen if people will mimic valenced behaviors to the same degree.
3. It might be especially important to explore negative behaviors and the consequences of coordination—typically positive—in this negative context.
4. Another question is when mimicry versus complementarity should be observed in the nonverbal behaviors of interaction partners. What is the relationship between mimicry and complementarity?
5. Future research can explore how mimicry plays out when there are more than two interactants. Examining who tends to be more mimicked within a group might have implications for understanding leadership development or popularity.
6. What mannerisms or gestures tend to be most mimicked? Are there certain personality traits that lead some people to be more mimicked than others?
7. What happens when people witness mimicry or a lack of mimicry between other people? What kinds of inferences are made about the dynamics of the relationship and about the individuals mimicking more or less than expected?

## DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

## LITERATURE CITED

- Aarts H, Chartrand T, Custers R, Danner U, Dik G, et al. 2005. Social stereotypes and automatic goal pursuit. *Soc. Cogn.* 23:465–90
- Aarts H, Gollwitzer PM, Hassin RR. 2004. Goal contagion: Perceiving is for pursuing. *J. Pers. Soc. Psychol.* 87:23–37
- Ashton-James C, Chartrand TL. 2009. Social cues for creativity: the impact of behavioral mimicry on convergent and divergent thinking. *J. Exp. Soc. Psychol.* 45:1036–40
- Ashton-James C, van Baaren RB, Chartrand TL, Decety J, Karremans J. 2007. Mimicry and me: the impact of mimicry on self-construal. *Soc. Cogn.* 25:518–35
- Bailenson JN, Yee N. 2005. Digital chameleons: automatic assimilation of nonverbal gestures in immersive virtual environments. *Psychol. Sci.* 16:814–19
- Bailenson JN, Yee N. 2007. Virtual interpersonal touch and digital chameleons. *J. Nonverbal Behav.* 31:225–42



- Goldin-Meadow S, Alibali MW. 2013. Gesture's role in speaking, learning, and creating language. *Annu. Rev. Psychol.* 64:257–84
- Guéguen N. 2009. Mimicry and seduction: an evaluation in a courtship context. *Soc. Influence* 4:249–55
- Guéguen N. 2011. The mimicker is a mirror of myself: impact of mimicking on self-consciousness and social anxiety. *Soc. Behav. Personal.* 39:725–28
- Guéguen N, Martin A. 2009. Incidental similarity facilitates behavioral mimicry. *Soc. Psychol.* 40:88–92
- Guéguen N, Martin A, Meineri S. 2011. Mimicry and helping behavior: an evaluation of mimicry on explicit helping request. *J. Soc. Psychol.* 151:1–4
- Guéguen N, Martin A, Simon J, Meineri S. 2012. Mimicry, sensitive topics, and surveys: when mimickers obtain more intimate revelations through mimicry. *Field Methods*. In press
- Häfner M, IJzerman H. 2011. The face of love: spontaneous accommodation as social emotional regulation. *Pers. Soc. Psychol. Bull.* 37:1551–63
- Harakeh Z, Engels RC, van Baaren RB, Scholte RH. 2007. Imitation of cigarette smoking: an experimental study in smoking in a naturalistic setting. *Drug Alcohol Depend.* 86:199–206
- Hardin CD, Higgins ET. 1996. Shared reality: how social verification makes the subjective objective. In *Handbook of Motivation and Cognition: The Interpersonal Context*, ed. ET Higgins, RM Sorrentino, 3:28–77. New York: Guilford
- Hassin RR, Aarts H, Ferguson MJ. 2005. Automatic goal inferences. *J. Exp. Soc. Psychol.* 41:129–40
- Hatfield E, Cacioppo JT, Rapson RL. 1994. *Emotional Contagion*. New York: Cambridge Univ. Press
- Hatfield E, Rapson RL, Le YL. 2009. Primitive emotional contagion: recent research. In *The Social Neuroscience of Empathy*, ed. J Decety, W Ickes, pp. 19–30. Cambridge, MA: MIT Press
- Hawk ST, Fischer AH, Van Kleef GA. 2011. Taking your place or matching your face: two paths to empathic embarrassment. *Emotion* 11:502–13
- Helt MS, Eigsti IM, Snyder PJ, Fein DA. 2010. Contagious yawning in autistic and typical development. *Child Dev.* 81:1620–31
- Hermans RCJ, Lichtwarck-Aschoff A, Bevelander KE, Herman CP, Larsen JK, Engels RC. 2012. Mimicry of food intake: the dynamic interplay between eating companions. *PLoS ONE* 7(2):e31027
- Herrmann A, Rossberg N, Huber F, Landwehr JR, Henkel S. 2011. The impact of mimicry on sales—evidence from field and lab experiments. *J. Econ. Psychol.* 32:502–14
- Hess U, Blairy S. 2001. Facial mimicry and emotional contagion to dynamic emotional facial expressions and their influence on decoding accuracy. *Int. J. Psychophysiol.* 40:129–41
- Heyes C. 2011. Automatic imitation. *Psychol. Bull.* 137:463–83
- Hogeveen J, Obhi SS. 2011. Altogether now: Activating interdependent self-construal induces hypermotor resonance. *Cogn. Neurosci.* 2:74–82
- Holler J, Wilkin K. 2011. Co-speech gesture mimicry in the process of collaborative referring during face-to-face dialogue. *J. Nonverbal Behav.* 35:133–53
- Hove MJ, Risen JL. 2009. It's all in the timing: Interpersonal synchrony increases affiliation. *Soc. Cogn.* 27:949–61
- Huntsinger JR, Lun J, Sinclair S, Clore GL. 2009. Contagion without contact: Anticipatory mood matching in response to affiliative motivation. *Pers. Soc. Psychol. Bull.* 35:909–22
- Hurley S. 2008. The shared circuits model (SCM): how control, mirroring, and simulation can enable imitation, deliberation, and mindreading. *Behav. Brain Sci.* 31:1–22
- Iacoboni M. 2009. Imitation, empathy, and mirror neurons. *Annu. Rev. Psychol.* 60:653–70
- Ireland ME, Pennebaker JW. 2010. Language style matching in writing: synchrony in essays, correspondence, and poetry. *J. Pers. Soc. Psychol.* 99:549–71
- Inzlicht M, Gutsell JN, Legault L. 2012. Mimicry reduces racial prejudice. *J. Exp. Soc. Psychol.* 48(1):361–65
- Jacob C, Guéguen N, Martin A, Boulbry G. 2011. Retail salespeople's mimicry of customers: effects on consumer behavior. *J. Retailing Consum. Serv.* 18:381–88
- Johnston L. 2002. Behavioral mimicry and stigmatization. *Soc. Cogn.* 20:18–35
- Jones SS. 2007. Imitation in infancy: the development of mimicry. *Psychol. Sci.* 18:593–99
- Julien D, Brault M, Chartrand T, Bégin J. 2000. Immediacy behaviours and synchrony in satisfied and dissatisfied couples. *Can. J. Behav. Sci.* 32:84–90

- Karremans JC, Verwijmeren T. 2008. Mimicking attractive opposite-sex others: the role of romantic relationship status. *Pers. Soc. Psychol. Bull.* 34:939–50
- Kavanagh L, Suhler C, Churchland P, Winkielman P. 2011. When it's an error to mirror: the surprising reputational costs of mimicry. *Psychol. Sci.* 22:1274–76
- Keller PE, Knoblich G, Repp BH. 2007. Pianists duet better when they play with themselves: on the possible role of action simulation in synchronization. *Conscious. Cogn. Int.* 7: 16:102–11
- Kirschner S, Tomasello M. 2010. Joint music making promotes prosocial behavior in 4-year-old children. *Evol. Hum. Behav.* 31:354–64
- Knoblich G, Butterfill S, Sebanz N. 2011. Psychological research on joint action: theory and data. In *The Psychology of Learning and Motivation*, ed. B Ross, pp. 59–101. Waltham, MA: Academic
- Knoblich G, Sebanz N. 2006. The social nature of perception and action. *Curr. Dir. Psychol. Sci.* 15:99–104
- Kouzakova M, Karremans JC, van Baaren RB, van Knippenberg A. 2010a. A stranger's cold shoulder makes the heart grow fonder: why not being mimicked by a stranger enhances longstanding relationship evaluations. *Soc. Psychol. Personal. Sci.* 1:87–93
- Kouzakova M, van Baaren R, van Knippenberg A. 2010b. Lack of behavioral imitation in human interactions enhances salivary cortisol levels. *Horm. Behav.* 57:421–26
- La France M. 1979. Nonverbal synchrony and rapport: analysis by the cross-lag panel technique. *Soc. Psychol. Q.* 42:66–70
- La France M. 1982. Posture mirroring and rapport. In *Interaction Rhythms: Periodicity in Communicative Behavior*, ed. M Davis, pp. 279–98. New York: Human Sci. Press
- La France M, Broadbent M. 1976. Group rapport: posture sharing as a nonverbal indicator. *Group Organ. Manage.* 1:328–33
- Laird JD, Alibozak T, Davainis D, Deignan K, Fontanella K, et al. 1994. Individual differences in the effects of spontaneous mimicry on emotional contagion. *Motiv. Emot.* 18:231–47
- Lakens D. 2010. Movement synchrony and perceived entitativity. *J. Exp. Soc. Psychol.* 46:701–8
- Lakens D, Stel M. 2011. If they move in sync, they must feel in sync: Movement synchrony leads to attributions of rapport and entitativity. *Soc. Cogn.* 29:1–14
- Lakin JL. 2006. Automatic cognitive processes and nonverbal communication. See Manusov & Patterson 2006, pp. 59–77
- Lakin JL. 2012. Behavioral mimicry and interactional synchrony. In *Handbook of Communication Science*, ed. JL Hall, ML Knapp. Berlin: Mouton de Gruyter. In press
- Lakin JL, Chartrand TL. 2003. Using nonconscious behavioral mimicry to create affiliation and rapport. *Psychol. Sci.* 14:334–39
- Lakin JL, Chartrand TL. 2005. Exclusion and nonconscious behavioral mimicry. In *The Social Outcast: Ostracism, Social Exclusion, Rejection, and Bullying*, ed. KD Williams, JP Forgas, W von Hippel, pp. 279–95. New York: Psychol. Press
- Lakin JL, Chartrand TL. 2012. Behavioral mimicry as an affiliative response to social exclusion. In *The Oxford Handbook of Social Exclusion*, ed. CN DeWall. New York: Oxford Univ. Press. In press
- Lakin JL, Chartrand TL, Arkin RM. 2008. I am too just like you: nonconscious behavioral mimicry as an automatic behavioral response to social exclusion. *Psychol. Sci.* 19:816–22
- Lakin JL, Jefferis VE, Cheng CM, Chartrand TL. 2003. The chameleon effect as social glue: evidence for the evolutionary significance of nonconscious mimicry. *J. Nonverbal Behav.* 27:145–62
- Leander NP, Chartrand TL, Bargh JA. 2012. You give me the chills: embodied reactions to inappropriate amounts of behavioral mimicry. *Psychol. Sci.* 23:772–79
- Leander NP, Chartrand TL, Wood W. 2011a. Mind your mannerisms: behavioral mimicry elicits stereotype conformity. *J. Exp. Soc. Psychol.* 47:195–201
- Leander NP, Shah JY, Chartrand TL. 2011b. The object of my protection: shielding fundamental motives from the implicit motivational influence of others. *J. Exp. Soc. Psychol.* 47:1078–87
- Leighton J, Bird G, Orsini C, Heyes C. 2010. Social attitudes modulate automatic imitation. *J. Exp. Soc. Psychol.* 46:905–10
- Levelt WJM, Kelter S. 1982. Surface form and memory in question answering. *Cogn. Psychol.* 14:78–106
- Lumsden J, Miles L, Richardson MJ, Smith C, Macrae N. 2012. Who syncs? Social motives and interpersonal coordination. *J. Exp. Soc. Psychol.* 48:746–51



- Lundqvist LO, Dimberg U. 1995. Facial expressions are contagious. *J. Psychophysiol.* 9:203–11
- Liepert R, Brass M. 2010. Automatic imitation of physically impossible movements. *Soc. Cognit.* 28:59–73
- Likowski KU, Muhlberger A, Seibt B, Pauli P, Weyers P. 2008. Modulation of facial mimicry by attitudes. *J. Exp. Soc. Psychol.* 44:1065–72
- Likowski KU, Weyers P, Seibt B, Stohr C, Pauli P, Muhlberger A. 2011. Sad and lonely? Sad mood suppresses facial mimicry. *J. Nonverbal Behav.* 35:101–17
- Liu J, Vohs KD, Smeesters D. 2011. Money and mimicry: when being mimicked makes people feel threatened. *Psychol. Sci.* 22:1150–51
- Loersch C, Aarts H, Payne BK, Jefferis VE. 2008. The influence of social groups on goal contagion. *J. Exp. Soc. Psychol.* 44:1555–58
- Macrae CN, Duffy OK, Miles LK, Lawrence J. 2008. A case of hand waving: action synchrony and person perception. *Cognition* 109:152–56
- Maddux WW, Mullen E, Galinsky AD. 2008. Chameleons bake bigger pies and take bigger pieces: Strategic behavioral mimicry facilitates negotiation outcomes. *J. Exp. Soc. Psychol.* 44:461–68
- Manusov V, Patterson ML, eds. 2006. *The SAGE Handbook of Nonverbal Communication*. Thousand Oaks, CA: Sage
- Maringer M, Krumhuber EG, Fischer AH, Niedenthal PM. 2011. Beyond smile dynamics: mimicry and beliefs in judgments of smiles. *Emotion* 11:181–87
- Markus HR, Kitayama S. 1991. Culture and the self: implications for cognition, emotion, and motivation. *Psychol. Rev.* 98:224–53
- Marsh KL, Richardson MJ, Schmidt RC. 2009. Social connection through joint action and interpersonal coordination. *Top. Cogn. Sci.* 1:320–39
- Martin A, Guéguen N, Fischer-Lokou J. 2010. The impact of guilt on mimicry behavior. *Soc. Behav. Personal.* 38:987–92
- Maurer RE, Tindall JH. 1983. Effect of postural congruence on client’s perception of counselor empathy. *J. Couns. Psychol.* 30:158–63
- Mazzurega M, Pavani F, Paladino MP, Schubert TW. 2011. It is a matter of time: self-other bodily merging in the context of synchronous but arbitrary related multisensory inputs. *Exp. Brain Res.* 213:213–21
- McIntosh DN. 2006. Spontaneous facial mimicry, liking, and emotional contagion. *Polish Psychol. Bull.* 37:31–42
- Meltzoff AN, Moore MK. 1983. Newborn infants imitate adult facial gestures. *Child Dev.* 54:702–9
- Miles LK, Griffiths JL, Richardson MJ, Macrae CN. 2010a. Too late to coordinate: contextual influences on behavioral synchrony. *Eur. J. Soc. Psychol.* 40:52–60
- Miles LK, Lumsden J, Richardson MJ, Macrae CN. 2011. Do birds of a feather move together? Group membership and behavioral synchrony. *Exp. Brain Res.* 211:495–503
- Miles LK, Nind LK, Henderson Z, Macrae CN. 2010b. Moving memories: behavioral synchrony and memory for self and others. *J. Exp. Soc. Psychol.* 46:457–60
- Miles LK, Nind LK, Macrae CN. 2009. The rhythm of rapport: interpersonal synchrony and social perception. *J. Exp. Soc. Psychol.* 45:585–89
- Neal DT, Chartrand TL. 2011. Embodied emotion perception: amplifying and dampening facial feedback modulates emotion perception accuracy. *Soc. Psychol. Pers. Sci.* 2:673–78
- Neda Z, Ravasz E, Brechte Y, Vicsek T, Barabasi AL. 2000. The sound of many hands clapping. *Nature* 403:849–50
- Neumann R, Strack F. 2000. “Mood contagion”: the automatic transfer of mood between persons. *J. Pers. Soc. Psychol.* 79:211–23
- Niederhoffer KG, Pennebaker JW. 2002. Linguistic style matching in social interaction. *J. Lang. Soc. Psychol.* 21:337–60
- Oberman LM, Winkielman P, Ramachandran VS. 2007. Face to face: Blocking facial mimicry can selectively impair recognition of emotional expressions. *Soc. Neurosci.* 2:167–78
- Obhi SS, Hogeveen J, Pascual-Leone A. 2011. Resonating with others: the effects of self-construal type on motor cortical output. *J. Neurosci.* 31:14531–35
- Oullier O, de Guzman GC, Jantzman KJ, Lagarde J, Scott Kelso JA. 2008. Social coordination dynamics: measuring human bonding. *Soc. Neurosci.* 3:178–92

- Over H, Carpenter M. 2009. Priming third-party ostracism increases affiliative imitation. *Dev. Sci.* 12:F1–8
- Paladino MP, Mazzurega M, Pavani F, Schubert TW. 2010. Synchronous multisensory stimulation blurs self-other boundaries. *Psychol. Sci.* 21:1202–7
- Provine RR. 1986. Yawning as a stereotyped action pattern and releasing stimulus. *Ethology* 72:109–22
- Ramanathan S, McGill AL. 2008. Consuming with others: social influences on moment-to-moment and retrospective evaluations of an experience. *J. Consum. Res.* 34:506–24
- Ramseyer F, Tschacher W. 2011. Nonverbal synchrony in psychotherapy: Coordinated body movement reflects relationship quality and outcome. *J. Consult. Clin. Psychol.* 79:284–95
- Redeker M, Stel M, Mastop J. 2011. Does mimicking others change your self-view? *J. Soc. Psychol.* 151:387–90
- Richardson DC, Dale R. 2005. Looking to understand: the coupling between speakers' and listeners' eye movements and its relationship to discourse comprehension. *Cogn. Sci.* 29:1046–60
- Richardson MJ, Marsh KL, Isenhowe RW, Goodman JR, Schmidt RC. 2007. Rocking together: dynamics of intentional and unintentional interpersonal coordination. *Hum. Mov. Sci.* 26:867–91
- Richardson MJ, Marsh KL, Schmidt RC. 2005. Effects of visual and verbal interaction on unintentional interpersonal coordination. *J. Exp. Psychol.: Hum. Percept. Perform.* 31:62–79
- Rizzolatti G, Craighero L. 2004. The mirror-neuron system. *Annu. Rev. Neurosci.* 27:169–92
- Sanchez-Burks J, Bartel CA, Blount S. 2009. Performance in intercultural interactions at work: cross-cultural differences in response to behavioral mirroring. *J. Appl. Psychol.* 94:216–23
- Schefflen AE. 1964. The significance of posture in communication systems. *Psychiatry* 27:316–31
- Schmidt RC, Carello C, Turvey MT. 1990. Phase transitions and critical fluctuations in the visual coordination of rhythmic movements between people. *J. Exp. Psychol.: Hum. Percept. Perform.* 16:227–47
- Schmidt RC, O'Brien B. 1997. Evaluating the dynamics of unintended interpersonal coordination. *Ecol. Psychol.* 9:189–206
- Schmidt RC, Richardson MJ. 2008. Dynamics of interpersonal coordination. In *Coordination: Neural, Behavioral and Social Dynamics*, ed. A Fuchs, VK Jirsa, pp. 281–307. Berlin: Springer-Verlag
- Sebanz N, Knoblich G. 2009. Prediction in joint action: what, when, and where. *Top. Cogn. Sci.* 1:353–67
- Shah JY. 2003. The motivational looking glass: how significant others implicitly affect goal appraisals. *J. Pers. Soc. Psychol.* 85:424–39
- Shockley K, Santana MV, Fowler CA. 2003. Mutual interpersonal postural constraints are involved in cooperative conversation. *J. Exp. Psychol.: Hum. Percept. Perform.* 29:326–32
- Sinclair S, Huntsinger J, Skorinko J, Hardin CD. 2005a. Social tuning of the self: consequences for the self-evaluations of stereotype targets. *J. Pers. Soc. Psychol.* 89:160–75
- Sinclair S, Lowery BS, Hardin CD, Colangelo A. 2005b. Social tuning of automatic racial attitudes: the role of affiliative motivation. *J. Pers. Soc. Psychol.* 89:583–92
- Sonnby-Borgström M. 2002. Automatic mimicry reactions as related to differences in emotional empathy. *Scand. J. Psychol.* 43:433–43
- Sonnby-Borgström M, Jönsson P, Svensson O. 2003. Emotional empathy as related to mimicry reactions at different levels of information processing. *J. Nonverbal Behav.* 27:3–23
- Sonnby-Borgström M, Jönsson P, Svensson O. 2008. Gender differences in facial imitation and verbally reported emotional contagion from spontaneous to emotionally regulated processing levels. *Scand. J. Psychol.* 49:111–22
- Stel M, Blascovich J, McCall C, Mastop J, van Baaren RB, Vonk R. 2010a. Mimicking disliked others: effects of a priori liking on the mimicry-liking link. *Eur. J. Soc. Psychol.* 40:867–80
- Stel M, Harinck F. 2011. Being mimicked makes you a prosocial voter. *Exp. Psychol.* 58:79–84
- Stel M, Mastop J, Strick M. 2011a. The impact of mimicking on attitudes toward products presented in TV commercials. *Soc. Influence* 6:142–52
- Stel M, Rispens S, Leliveld M, Lokhorst AM. 2011b. The consequences of mimicry for prosocials and proselves: effects of social value orientation on the mimicry-liking link. *Eur. J. Soc. Psychol.* 41:269–74
- Stel M, van Baaren RB, Blascovich J, van Dijk E, McCall C, et al. 2010b. Effects of a priori liking on the elicitation of mimicry. *Exp. Psychol.* 57:412–18
- Stel M, van Baaren RB, Vonk R. 2008. Effects of mimicking: acting prosocially by being emotionally moved. *Eur. J. Soc. Psychol.* 38:965–76

- Stel M, van den Bos K, Bal M. 2012. On mimicry and the psychology of the belief in a just world: Imitating the behaviors of others reduces the blaming of innocent victims. *Soc. Justice Res.* 25:14–24
- Stel M, van Dijk, E, Olivier E. 2009. You want to know the truth? Then don't mimic! *Psychol. Sci.* 20:693–99
- Stel M, van Knippenberg A. 2008. The role of facial mimicry in the recognition of affect. *Psychol. Sci.* 19:984–85
- Stel M, Vonk R. 2009. Empathizing via mimicry depends on whether emotional expressions are seen as real. *Eur. Psychol.* 14:342–50
- Stel M, Vonk R. 2010. Mimicry in social interaction: benefits for mimickers, mimickees, and their interaction. *Br. J. Psychol.* 101:311–23
- Swaab RI, Maddux WW, Sinaceur M. 2011. Early words that work: when and how virtual linguistic mimicry facilitates negotiation outcomes. *J. Exp. Soc. Psychol.* 47:616–21
- Tanner RJ, Ferraro R, Chartrand TL, Bettman JR, van Baaren R. 2008. Of chameleons and consumption: the impact of mimicry on choice and preferences. *J. Consum. Res.* 34:754–66
- Termine NT, Izard CE. 1988. Infants' responses to their mothers' expressions of joy and sadness. *Dev. Psychol.* 24:223–29
- Tia B, Saimpont A, Paizis C, Mourey F, Fadiga L, Pozzo T. 2011. Does observation of postural imbalance induce a postural reaction? *PLoS ONE* 6(3):e17799
- Tickle-Degnen L. 2006. Nonverbal behavior and its functions in the ecosystem of rapport. See Manusov & Patterson 2006, pp. 381–99
- Tiedens LZ, Fragale AR. 2003. Power moves: complementarity in dominant and submissive nonverbal behavior. *J. Pers. Soc. Psychol.* 84:558–68
- Tsai JC, Sebanz N, Knoblich G. 2011. The GROOP effect: Groups mimic group actions. *Cognition* 118:135–40
- Vacharkulksemsuk T, Fredrickson BL. 2012. Strangers in sync: achieving embodied rapport through shared movements. *J. Exp. Soc. Psychol.* 48:399–402
- Valdesolo P, DeSteno D. 2011. Synchrony and the social tuning of compassion. *Emotion* 11:262–66
- Valdesolo P, Ouyang J, DeSteno D. 2010. The rhythm of joint action: Synchrony promotes cooperative ability. *J. Exp. Soc. Psychol.* 46:693–95
- van Baaren RB, Fockenberg DA, Holland RW, Janssen L, van Knippenberg A. 2006. The moody chameleon: the effect of mood on non-conscious mimicry. *Soc. Cogn.* 24:426–37
- van Baaren RB, Holland RW, Kawakami K, van Knippenberg A. 2004a. Mimicry and prosocial behavior. *Psychol. Sci.* 15:71–74
- van Baaren RB, Holland RW, Steenaert B, van Knippenberg A. 2003a. Mimicry for money: behavioral consequences of imitation. *J. Exp. Soc. Psychol.* 39:393–98
- van Baaren RB, Horgan TG, Chartrand TL, Dijkmans M. 2004b. The forest, the trees, and the chameleon: context dependence and mimicry. *J. Pers. Soc. Psychol.* 86:453–59
- van Baaren R, Janssen L, Chartrand TL, Dijksterhuis A. 2009. Where is the love? The social aspect of mimicry. *Philos. Trans. R. Soc. B* 364:2381–89
- van Baaren RB, Maddux WW, Chartrand TL, de Bouter C, van Knippenberg A. 2003b. It takes two to mimic: behavioral consequences of self-construals. *J. Pers. Soc. Psychol.* 84:1093–102
- van der Schalk J, Fischer A, Doosje B, Wigboldus D, Hawk S, et al. 2011. Convergent and discriminant responses to emotional displays of ingroups and outgroups. *Emotion* 11:286–98
- van der Velde SW, Stapel DA, Gordijn EH. 2010. Imitation of emotion: when meaning leads to aversion. *Eur. J. Soc. Psychol.* 40:536–42
- van Leeuwen ML, van Baaren RB, Martin D, Dijksterhuis A, Bekkering H. 2009a. Executive functioning and imitation: Increasing working memory load facilitates behavioural imitation. *Neuropsychologia* 47:3265–70
- van Leeuwen ML, Veling H, van Baaren RB, Dijksterhuis A. 2009b. The influence of facial attractiveness on imitation. *J. Exp. Soc. Psychol.* 45:1295–98
- van Straaten I, Engels RC, Finkenauer C, Holland RW. 2008. Sex differences in short-term mate preferences and behavioral mimicry: a semi-naturalistic experiment. *Arch. Sex. Behav.* 37:902–11
- Van Swol LM. 2003. The effects of nonverbal mirroring on perceived persuasiveness, agreement with an imitator, and reciprocity in a group discussion. *Commun. Res.* 30:461–80
- Van Swol LM, Drury M. 2006. *The effects of shared opinions on nonverbal mimicry*. Paper presented at Annu. Int. Commun. Assoc. Conf., Dresden, Germany

- van Ulzen NR, Lamoth CJ, Daffertshofer A, Semin GR, Beek PJ. 2008. Characteristics of instructed and uninstructed interpersonal coordination while walking in pairs. *Neurosci. Lett.* 432:88–93
- Varlet M, Marin L, Lagarde J, Bardy BG. 2010. Social postural coordination. *J. Exp. Psychol.: Hum. Percept. Perform.* 37:473–83
- Vrijzen JN, Lange WG, Becker ES, Rick M. 2010a. Socially anxious individuals lack unintentional mimicry. *Behav. Res. Ther.* 48:561–64
- Vrijzen JN, Lange WG, Dotsch R, Wigboldus DHJ, Rinck M. 2010b. How do socially anxious women evaluate mimicry? A virtual reality study. *Cogn. Emot.* 24:840–47
- Wang Y, Newport R, Hamilton AFC. 2010. Eye contact enhances mimicry of intransitive hand movements. *Biol. Lett.* 7:7–10
- Webb JT. 1969. Subject speech rates as a function of interviewer behaviour. *Lang. Speech* 12:54–67
- Webb OJ, Eves FF, Smith L. 2011. Investigating behavioural mimicry in the context of stair/escalator choice. *Br. J. Health Psychol.* 16:373–85
- White K, Argo J. 2011. When imitation doesn't flatter: the role of consumer distinctiveness in response to mimicry. *J. Consum. Res.* 38(4):667–80
- Wilermuth SS. 2012a. Synchronous activity boosts compliance with requests to aggress. *J. Exp. Soc. Psychol.* 48:453–56
- Wilermuth SS. 2012b. Synchrony and destructive obedience. *Soc. Influence* 7(2):78–89
- Wilermuth SS, Heath C. 2009. Synchrony and cooperation. *Psychol. Sci.* 20:1–5
- Yabar Y, Johnston L, Miles L, Peace V. 2006. Implicit behavioral mimicry: investigating the impact of group membership. *J. Nonverbal Behav.* 30:97–113
- Zhong CB, Leonardelli GJ. 2008. Cold and lonely: Does social exclusion literally feel cold? *Psychol. Sci.* 19:838–42



# Contents

## Prefatory

Shifting Gears: Seeking New Approaches for Mind/Brain Mechanisms <i>Michael S. Gazzaniga</i> .....	1
---	---

## Biological Bases of Behavior

The Endocannabinoid System and the Brain <i>Raphael Mechoulam and Linda A. Parker</i> .....	21
--	----

## Vision

Synesthesia <i>Jamie Ward</i> .....	49
--	----

## Scene Perception, Event Perception, Object Recognition

Visual Aesthetics and Human Preference <i>Stephen E. Palmer, Karen B. Schloss, and Jonathan Sammartino</i> .....	77
---	----

## Attention and Performance

Detecting Consciousness: A Unique Role for Neuroimaging <i>Adrian M. Owen</i> .....	109
--	-----

Executive Functions <i>Adele Diamond</i> .....	135
---	-----

## Animal Learning and Behavior

The Neuroscience of Learning: Beyond the Hebbian Synapse <i>C.R. Gallistel and Louis D. Matzel</i> .....	169
---	-----

## Evolutionary Psychology

Evolutionary Psychology: New Perspectives on Cognition and Motivation <i>Leda Cosmides and John Tooby</i> .....	201
---	-----

Origins of Human Cooperation and Morality <i>Michael Tomasello and Amrisha Vaish</i> .....	231
---	-----

## Language and Communication

- Gesture's Role in Speaking, Learning, and Creating Language  
*Susan Goldin-Meadow and Martha Wagner Alibali* ..... 257

## Nonverbal and Verbal Communication

- The Antecedents and Consequences of Human Behavioral Mimicry  
*Tanya L. Chartrand and Jessica L. Lakin* ..... 285

## Intergroup Relations, Stigma, Stereotyping, Prejudice, Discrimination

- Sexual Prejudice  
*Gregory M. Herek and Kevin A. McLemore* ..... 309

## Social Neuroscience

- A Cultural Neuroscience Approach to the Biosocial Nature  
of the Human Brain  
*Shibui Han, Georg Northoff, Kai Vogeley, Bruce E. Wexler,  
Shinobu Kitayama, and Michael E.W. Varnum* ..... 335

## Organizational Climate/Culture

- Organizational Climate and Culture  
*Benjamin Schneider, Mark G. Ehrhart, and William H. Macey* ..... 361

## Industrial Psychology/Human Resource Management

- Employee Recruitment  
*James A. Breugh* ..... 389

## Learning and Performance in Educational Settings

- Self-Regulated Learning: Beliefs, Techniques, and Illusions  
*Robert A. Bjork, John Dunlosky, and Nate Kornell* ..... 417

## Teaching of Subject Matter

- Student Learning: What Has Instruction Got to Do With It?  
*Hee Seung Lee and John R. Anderson* ..... 445

## Health Psychology

- Bringing the Laboratory and Clinic to the Community: Mobile  
Technologies for Health Promotion and Disease Prevention  
*Robert M. Kaplan and Arthur A. Stone* ..... 471

## Research Methodology

- Multivariate Statistical Analyses for Neuroimaging Data  
*Anthony R. McIntosh and Bratislav Mišić* ..... 499



Social Network Analysis: Foundations and Frontiers on Advantage <i>Ronald S. Burt, Martin Kilduff, and Stefano Tasselli</i> .....	527
--	-----

## Indexes

Cumulative Index of Contributing Authors, Volumes 54–64 .....	549
Cumulative Index of Chapter Titles, Volumes 54–64 .....	554

## Errata

An online log of corrections to *Annual Review of Psychology* articles may be found at  
<http://psych.AnnualReviews.org/errata.shtml>



# ANNUAL REVIEWS

It's about time. Your time. It's time well spent.

## New From Annual Reviews:

### ***Annual Review of Organizational Psychology and Organizational Behavior***

Volume 1 • March 2014 • Online & In Print • <http://orgpsych.annualreviews.org>

Editor: **Frederick P. Morgeson**, *The Eli Broad College of Business, Michigan State University*

The *Annual Review of Organizational Psychology and Organizational Behavior* is devoted to publishing reviews of the industrial and organizational psychology, human resource management, and organizational behavior literature. Topics for review include motivation, selection, teams, training and development, leadership, job performance, strategic HR, cross-cultural issues, work attitudes, entrepreneurship, affect and emotion, organizational change and development, gender and diversity, statistics and research methodologies, and other emerging topics.

**Complimentary online access to the first volume will be available until March 2015.**

#### TABLE OF CONTENTS:

- *An Ounce of Prevention Is Worth a Pound of Cure: Improving Research Quality Before Data Collection*, Herman Aguinis, Robert J. Vandenberg
- *Burnout and Work Engagement: The JD-R Approach*, Arnold B. Bakker, Evangelia Demerouti, Ana Isabel Sanz-Vergel
- *Compassion at Work*, Jane E. Dutton, Kristina M. Workman, Ashley E. Hardin
- *Constructively Managing Conflict in Organizations*, Dean Tjosvold, Alfred S.H. Wong, Nancy Yi Feng Chen
- *Coworkers Behaving Badly: The Impact of Coworker Deviant Behavior upon Individual Employees*, Sandra L. Robinson, Wei Wang, Christian Kiewitz
- *Delineating and Reviewing the Role of Newcomer Capital in Organizational Socialization*, Talya N. Bauer, Berrin Erdogan
- *Emotional Intelligence in Organizations*, Stéphane Côté
- *Employee Voice and Silence*, Elizabeth W. Morrison
- *Intercultural Competence*, Kwok Leung, Soon Ang, Mei Ling Tan
- *Learning in the Twenty-First-Century Workplace*, Raymond A. Noe, Alena D.M. Clarke, Howard J. Klein
- *Pay Dispersion*, Jason D. Shaw
- *Personality and Cognitive Ability as Predictors of Effective Performance at Work*, Neal Schmitt
- *Perspectives on Power in Organizations*, Cameron Anderson, Sebastien Brion
- *Psychological Safety: The History, Renaissance, and Future of an Interpersonal Construct*, Amy C. Edmondson, Zhike Lei
- *Research on Workplace Creativity: A Review and Redirection*, Jing Zhou, Inga J. Hoever
- *Talent Management: Conceptual Approaches and Practical Challenges*, Peter Cappelli, JR Keller
- *The Contemporary Career: A Work-Home Perspective*, Jeffrey H. Greenhaus, Ellen Ernst Kossek
- *The Fascinating Psychological Microfoundations of Strategy and Competitive Advantage*, Robert E. Ployhart, Donald Hale, Jr.
- *The Psychology of Entrepreneurship*, Michael Frese, Michael M. Gielnik
- *The Story of Why We Stay: A Review of Job Embeddedness*, Thomas William Lee, Tyler C. Burch, Terence R. Mitchell
- *What Was, What Is, and What May Be in OP/OB*, Lyman W. Porter, Benjamin Schneider
- *Where Global and Virtual Meet: The Value of Examining the Intersection of These Elements in Twenty-First-Century Teams*, Cristina B. Gibson, Laura Huang, Bradley L. Kirkman, Debra L. Shapiro
- *Work-Family Boundary Dynamics*, Tammy D. Allen, Eunae Cho, Laurenz L. Meier

Access this and all other Annual Reviews journals via your institution at [www.annualreviews.org](http://www.annualreviews.org).

## ANNUAL REVIEWS | Connect With Our Experts

Tel: 800.523.8635 (US/CAN) | Tel: 650.493.4400 | Fax: 650.424.0910 | Email: [service@annualreviews.org](mailto:service@annualreviews.org)





# ANNUAL REVIEWS

It's about time. Your time. It's time well spent.

## New From Annual Reviews:

### *Annual Review of Statistics and Its Application*

Volume 1 • Online January 2014 • <http://statistics.annualreviews.org>

Editor: **Stephen E. Fienberg**, *Carnegie Mellon University*

Associate Editors: **Nancy Reid**, *University of Toronto*

**Stephen M. Stigler**, *University of Chicago*

The *Annual Review of Statistics and Its Application* aims to inform statisticians and quantitative methodologists, as well as all scientists and users of statistics about major methodological advances and the computational tools that allow for their implementation. It will include developments in the field of statistics, including theoretical statistical underpinnings of new methodology, as well as developments in specific application domains such as biostatistics and bioinformatics, economics, machine learning, psychology, sociology, and aspects of the physical sciences.

**Complimentary online access to the first volume will be available until January 2015.**

#### TABLE OF CONTENTS:

- *What Is Statistics?* Stephen E. Fienberg
- *A Systematic Statistical Approach to Evaluating Evidence from Observational Studies*, David Madigan, Paul E. Stang, Jesse A. Berlin, Martijn Schuemie, J. Marc Overhage, Marc A. Suchard, Bill Dumouchel, Abraham G. Hartzema, Patrick B. Ryan
- *The Role of Statistics in the Discovery of a Higgs Boson*, David A. van Dyk
- *Brain Imaging Analysis*, F. DuBois Bowman
- *Statistics and Climate*, Peter Guttorp
- *Climate Simulators and Climate Projections*, Jonathan Rougier, Michael Goldstein
- *Probabilistic Forecasting*, Tilmann Gneiting, Matthias Katzfuss
- *Bayesian Computational Tools*, Christian P. Robert
- *Bayesian Computation Via Markov Chain Monte Carlo*, Radu V. Craiu, Jeffrey S. Rosenthal
- *Build, Compute, Critique, Repeat: Data Analysis with Latent Variable Models*, David M. Blei
- *Structured Regularizers for High-Dimensional Problems: Statistical and Computational Issues*, Martin J. Wainwright
- *High-Dimensional Statistics with a View Toward Applications in Biology*, Peter Bühlmann, Markus Kalisch, Lukas Meier
- *Next-Generation Statistical Genetics: Modeling, Penalization, and Optimization in High-Dimensional Data*, Kenneth Lange, Jeanette C. Papp, Janet S. Sinsheimer, Eric M. Sobel
- *Breaking Bad: Two Decades of Life-Course Data Analysis in Criminology, Developmental Psychology, and Beyond*, Elena A. Erosheva, Ross L. Matsueda, Donatello Telesca
- *Event History Analysis*, Niels Keiding
- *Statistical Evaluation of Forensic DNA Profile Evidence*, Christopher D. Steele, David J. Balding
- *Using League Table Rankings in Public Policy Formation: Statistical Issues*, Harvey Goldstein
- *Statistical Ecology*, Ruth King
- *Estimating the Number of Species in Microbial Diversity Studies*, John Bunge, Amy Willis, Fiona Walsh
- *Dynamic Treatment Regimes*, Bibhas Chakraborty, Susan A. Murphy
- *Statistics and Related Topics in Single-Molecule Biophysics*, Hong Qian, S.C. Kou
- *Statistics and Quantitative Risk Management for Banking and Insurance*, Paul Embrechts, Marius Hofert

Access this and all other Annual Reviews journals via your institution at [www.annualreviews.org](http://www.annualreviews.org).

## ANNUAL REVIEWS | Connect With Our Experts

Tel: 800.523.8635 (US/CAN) | Tel: 650.493.4400 | Fax: 650.424.0910 | Email: [service@annualreviews.org](mailto:service@annualreviews.org)

