New Perspectives on Emotional Contagion:

A Review of Classic and Recent Research on Facial Mimicry and

Contagion

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Abstract

Recently, scholars from a wide variety of disciplines, using a variety of scientific techniques, have begun to study the influence of attention, facial mimicry, and social context on emotional contagion. In this paper we will review the classic evidence documenting the role of attention, facial mimicry, and feedback in sparking primitive emotional contagion. Then we will discuss the new evidence which scholars have amassed to help us better understand the role of facial mimicry in fostering contagion and the ability to "read" others' thoughts, feelings, and emotions. Finally, we will briefly speculate as to where future research might be headed.

Introduction

Recently, scholars from a wide variety of disciplines, using a variety of scientific techniques, have begun to study the influence of attention, social context, and facial mimicry on emotional contagion. These far-flung disciplines include cultural psychology, anthropology, primatology, the neurosciences, biology, social psychology, and history. Primitive emotional contagion appears to be a basic building block of human interaction—assisting in "mind-reading" (allowing people to understand and share the thoughts and feelings of others), and facilitating the coordination and synchronization of those interactions. Such contagion is also an important component of empathy.

In this paper we will review the classic evidence documenting the role of attention, facial mimicry, and feedback in sparking primitive emotional contagion.[1] Then we will discuss the new evidence which scholars from a variety of disciplines have amassed to help us better understand the role of facial mimicry in fostering contagion. Finally, we will briefly speculate as to where future research might be headed.

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[1] For brevity's sake, throughout this paper we will use the term "emotional contagion" as shorthand for "primitive emotional contagion."

Let us begin by defining "emotion" and "primitive emotional contagion," and reviewing the premises of the theory of emotional contagion.

Emotional Contagion

Defining Emotion.   Most social psychologists would probably agree that emotional "packages" are comprised of many components—including conscious awareness; facial, vocal, and postural expressions; neurophysiological and autonomic nervous system activity; and instrumental behaviors. Different areas of the brain process the various aspects of emotion. Yet, because the brain integrates the emotional information it receives, each of the components acts on and is acted upon by the others (Hatfield, Cacioppo, & Rapson, 1994).

Early emotion theorists focused on the question of sequence: Which comes first, the cognitive, somatovisceral, or behavioral aspects of emotion? (Buck, 2014). Recent theorists have moved away from such linear, uni-deterministic reasoning and have decided, instead, that "it depends." Emotional stimuli may well trigger all three aspects of emotion almost simultaneously. Which appears first depends on the person and the context. Thus, theorists are increasingly asking how the

components interact. Laird and Bresler (1992) summarized their

position this way:

> All components of the emotional episode are ordinarily gener-
> ated, more or less independently, by some central mecha-
> nism, but activation of any one may increase activity of any
> other. Their interactive effects might arise because of the
> way the organism is built . . . or because of classical
> conditioning, produced by the long history of paired
> occurrence of emotional responses (p. 49, original MS.)

Our definition of emotion, then, stresses the importance of all the

elements of the emotional "package" in shaping emotional experience

and behavior.

Defining Emotional Contagion. Emotional contagion, we believe, is

best conceptualized as a multiply determined family of cognitive,

psychophysiological, behavioral, and social phenomena. Since contagion

can be produced by innate stimulus features, acquired stimulus features,

and/or mental simulations or emotional imagery, we say it is *multiply*

determined.

Because contagion manifests in a complex of responses, it

represents a *family* of phenomena. (An angry stimulus face, for example,

may spark an angry face *and* an angry voice: Hawk, 2010; Hawk, Fischer,

& Van Kleef, 2012). Emotional contagion is also a *multilevel*

phenomenon: The precipitating stimuli arise from one individual, act upon

(i.e., be perceived and interpreted by) one or more other individuals, and yield corresponding or corresponding/complementary emotions in these individuals. Thus, an important consequence of emotional contagion is an attentional, emotional, and behavioral synchrony that has the same adaptive utility (and drawbacks) for social entities (dyads or groups) as has emotion for any individual.

A note: Some critics have asked, "Why does an angry stimulus sometimes spark not anger but fear in others?" (What some have called *countercontagion*)? (see Lanzetta nd his colleagues (e.g., McHugo, et al., 1985). We contend that when faced by a powerful and angry adversary, targets *would* "catch" that anger but that anger is likely to be extremely fleeting. People would quickly recognize that they were in trouble, and fear would soon swamp those angry feelings. In brief, contagious anger would be replaced by a flood self-protective fear and a desire to appease the powerful one or to flee.

The focus in this article will be on rudimentary or *primitive emotional contagion*—that process which is relatively automatic, unintentional, uncontrollable, and largely inaccessible to conversant awareness. Hatfield and her colleagues (1992) defined primitive *emotional contagion* as:

The tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person's and, consequently, to converge emotionally.

The *Emotional Contagion Scale* was designed to assess people's susceptibility to catching joy and happiness, love, fear and anxiety, anger, and sadness and depression, as well as emotions in general (Hatfield, Cacioppo, & Rapson, 1994, p. 157; Doherty, 1997). This scale has been translated into a variety of languages—including Finnish, German, Greek, Telugu and Hindi (the state language of India), Japanese, Portuguese, and Swedish.

Mechanisms of Emotional Contagion

There is considerable evidence that the process of primitive emotional contagion occurs in three stages: Mimicry -> Feedback -> Contagion.

Proposition 1. In conversation, people tend to automatically and continuously mimic and synchronize their movements with the facial expressions, vocal productions, postures, movements, and instrumental behaviors of others.

In this paper, we will be considering only facial mimicry. (The literature on the link between any and all forms of mimicry and contagion is simply too large to review it all here.) For a quick but thorough review of the evidence that mimicry is innate, instantaneous, and ubiquitous, see

Hatfield, Cacioppo, and Rapson (1992) and Hatfield, Carpenter, and

Rapson (2014).

Proposition 2. Subjective emotional experiences are affected, moment-to-moment, by the activation and/or feedback from such mimicry.

Edgar Allan Poe (1915), in "The Purloined Letter," contended

that if people consciously imitate others' facial expressions, they will

soon come to feel as the others do:

> When I wish to find out how wise, or how stupid, or how good, or how wicked is any one, or what are his thoughts at the moment, I fashion the expression of my face, as accurately as possible, in accordance with the expression of his, and then wait to see what thoughts or sentiments arise in my mind or heart, as if to match or correspond with the expression (p. 100).

There is considerable evidence that people do in fact tend to feel

emotions consistent with the facial, vocal, and postural expressions they

adopt. When people mimic expressions of fear, anger, sadness, joy, love,

or disgust, they tend to feel a pale reflection of those *specific* emotions.

Evidence for Edgar Allan Poe's contention, that the feedback from

mimicry causes us to feel what another feels, comes from a wide variety

of sources (see Ekman, Levenson, & Friesen, 1983; Laird, 1984; Hatfield,

et al., 1992. Additional evidence will be discussed later in this review.)

Proposition 3. Thus, people tend to "catch" others' emotions, moment-to-moment.

Scholars from a variety of disciplines (clinical observers, neuroscientists, primatologists, social psychologists, sociologists, life span researchers, and historians) provide evidence that people do in fact frequently catch one another's emotions (for reviews see Chartrand, Maddux, & Lakin, 2005; Lundqvist, 1993; Hatfield et al., 1992, 2009, and 2014; Hess and Fischer, 2013). This feedback and contagion assists them in understanding the thoughts and feelings of others (Hsee, et al., 1992).

In light of current researchers' interests, we will add a forth proposition:

Proposition 4: In attempting to divine another's emotions, people rely on cognitive assessments as well as feedback from the emotions they have caught.

The research on contagion underscores the fact that people use multiple means to gain information about others' cognitive and emotional states. Conscious analytic skills can help one figure out what makes other people "tick". But if people pay careful attention to the emotions they themselves experience in the company of others, they may well gain an extra edge into "feeling themselves" into others' emotional states. Both sources of information provide invaluable information. There is considerable social-psychological and social-

psycho-physiological evidence that both what people *think* and what they *feel* may provide valuable, and different, information about others. In one experiment by Hsee, Hatfield, and Chemtob (1992), for example, the authors found that people's conscious assessments of what others "must be" feeling were heavily influenced by what the others claimed to be experiencing. People's own emotions, however, were more influenced by the others' non-verbal and unconscious clues as to what they were really feeling. Other researchers who have explored the role of mimicry, feedback, and contagion on people's ability to read others' emotions include Neal and Chartrand (2011).

The Relationship Between Attention, Mimicry, Feedback, and Emotional Contagion

How important is facial mimicry/feedback for primitive emotional contagion? Is it necessary, sufficient, or merely a small part of emotional experience? Exactly how are the two linked? There is considerable evidence indicating that *generally* the manipulation of people's emotional expressions does spark dramatic changes in their emotional experience

A note: Ideally, we would expect the most mimicry and contagion when a person, in a natural setting, views someone experiencing and expressing strong emotion via facial, vocal, and postural indicants.

Ideally, the stimulus person would be in motion and the emotional display would last for some seconds. (For evidence that static expressions produce less contagion than faces in motion, see Ambadar, Schooler, & Cohn, 2004; Sato, Fujimura & Suzuki, 2008). Since most theorists have assumed that it is the face that is the "mirror of the soul" and the most potent indicator of emotion, they have studied people's reactions to facial displays. Other researchers have argued that other sources are important too—perhaps even more powerful than facial displays. Let us consider that research now.

Evidence supporting a facial mimicry -> contagion link

In a variety of studies, researchers have demonstrated that people tend to feel emotions consistent with the facial expressions they adopt and to have difficulty experiencing emotions inconsistent with those they adopt. Furthermore, the link between facial expression and emotion appears to be quite specific: when people produce a facial expression of fear, anger, sadness, or disgust, they are more likely to feel the emotion associated not with just any emotion, but with that specific expression. Let us now consider this research.

In attempting to determine whether facial mimicry does indeed spark contagion, scientists have used a variety of strategies to induce

participants to adopt specified facial expressions. Some scholars simply

ask participants to exaggerate or to play down their naturally occurring

emotional facial expressions. They then try to find out what effect this

has on the subjects' emotional responses. Generally, subjects report

that a film was funnier or shocks were more painful when they

exaggerated their amusement or pain than when they muted their facial

reactions (Kopel & Arkowitz, 1974; Kraut, 1982; Lanzetta, Biernat, &

Kleck, 1982; Lanzetta, Cartwright-Smith, & Kleck, 1976; Zuckerman,

Klorman, Larrance, & Speigel, 1981.) Others try to "trick" participants

into adopting a given emotional expression (Duclos, et al., 1989;

Kellerman, Lewis & Laird, 1989; Laird, 1974; Laird, 1984; Laird,

Wagener, Halal, & Szegda, 1982; Larsen, Kasimatis, & Frey, 1992;

Strack, Martin, & Stepper, 1988). Others arrange things so subjects will

unconsciously mimic others' emotional facial expressions (Hsee, Hatfield,

Carlson, & Chemtob, 1990, 1993; Hsee, Hatfield, & Chemtob, 1992).

In all three types of experiments, evidence for the Sherlock

Holmes' contention that mimicry and feedback cause people to feel at

least faint traces of the emotions another expresses is plentiful. Scholars

find that people are affected by the facial expressions they adopt—be

they happy or sad (Bush, Barr, McHugo, & Lanzetta, 1989; Hsee,

Hatfield, Carlson, & Chemtob, 1990, 1993; Hsee, Hatfield, & Chemtob,

1992; Laird, Wagener, Halal, & Szegda, 1982; Larsen, Kasimatis, & Frey,

1992; Strack, Martin, & Stepper, 1988; and Uchino, Hatfield, Carlson, &

Chemtob, 1991), angry (Laird, 1984; Lanzetta & Orr, 1986), or

expressing romantic love (Kellerman, Lewis, & Laird, 1989).   For more

general reviews, see Adelmann and Zajonc (1989), Ekman, et al., (1983),

Hatfield, et al., (1992), and Laird (1984).

The Impact of Botox on Emotional Perception and Experience

Theorists have long been interested in the impact of various

disabilities (say, Bell's Palsy or the Moebius syndrome [which produce

facial paralysis], or spinal-cord injuries [which reduce or eliminate

peripheral feedback]), or the effect of various medications (say, beta-

blockers), or the curare derivative succinylcholine [which paralyzes

muscles]) on the experience of emotion (Reisenzein & Stephan,

2014).

In the past few years, in an intriguing set of experiments,

researchers have begun to study the impact of Botox injections on

the ability to identify the emotions of others and the readiness to

experience emotions oneself. Neal and Chartrand (2011) explored the

impact of Botox injections on mimicry and facial feedback on

amplifying or dampening emotions. In Experiment 1 they observed

people who had recently received Botox injections (which paralyze

facial muscles). They found that Botox patients were less successful

at identifying emotions than were their peers. In a second

experiment, they applied a gel that made the skin resistant to

underlying muscle contractions. In this situation, participants were

forced to exaggerate their facial reactions and, as predicted, emotion

perception improved. (Additional evidence that Botox also shapes

people's emotional experiences can be found in Finzi & Rosenthal,

2013)

In a series of experiments, researchers have found that the link

between facial expression and emotion is generally quite specific: when

people produce a facial expression of fear, anger, sadness, or disgust,

they are more likely to feel the emotion associated not just with any

emotion, but with that specific expression—i.e., those who adopt a sad

expression feel sad, not angry (Duclos, et al., 1989; Duncan & Laird,

1977; Kellerman, et al., 1989; Kleinke & Walton, 1982; Laird, 1974 and

1984; Laird & Bresler, 1992; Laird & Crosby, 1974; Laird, et al. 1982;

Larsen, et al., 1992; McArthur, Simon, & Jaffee, 1980; Rhodenwalt &

Comer, 1979; Rutledge & Hupka, 1985; Strack, et al., 1988.) Only a few

researchers have failed to secure such results. For a critique of the facial

feedback research, see Matsumoto, (1987), Tourangeau and Ellsworth

(1979), and Winton (1986).

Cross-Channel Mimicry and Contagion

Hawk, Fischer, and van Kleef (2012), utilizing the theory of

embodied responses, argues that emotion is an integrated process. They

observe:

> Embodiment theories . . . propose that individuals process
> emotion-related information by reactivating neural states
> involved in their own prior perceptual, expressive, and
> affective experiences. Facial and vocal expressions hold
> differential associations with the visual and auditory
> perceptual modalities, respectively, but both represent
> examples of behaviors that bridge motoric and affective
> modalities. When individuals experience a combination of
> emotional states and nonverbal expressions with sufficient
> frequency, such as feeling happy, smiling, and laughing, later
> introspection about a stimulus (e.g., another's laughter) can
> activate dynamic simulations of associated behaviors and
> feelings. This pattern completion "fills in" unperceived
> elements of the original experience . . . and may manifest as
> overt motor behavior (e.g., smiling) and subjective states
> (e.g., feeling happy). These simulations, based on limited
> perceptual information, facilitate cognitive, emotional,
> and behavioral engagement with related stimuli (p. 796).

On the basis of this reasoning, the authors postulate the existence

of cross-channel mimicry. (For example, in a dark and smoky comedy

club, when a patron witnesses the laughter of those around him, he is

likely to smile as well as mimicking the audience's laughter. Both sensory modalities combine to lighten his mood.)

In a series of studies, focusing on facial and emotional reactions to nonverbal emotion vocalizations, Hawk and his colleagues demonstrated that: (1) both hearing and reproducing vocalizations of anger, disgust, happiness, and sadness produced specific, congruent, facial behaviors, as well as congruent self-reported emotions; (2) the inhibition of congruent facial actions impaired listeners' processing of emotion vocalizations, as well as their experiences of congruent subjective states. Results supported the idea that cross-channel simulations of others' states serve facilitative functions similar to more strict imitations of observed expressive behavior, suggesting flexibility in the motoric and affective systems involved in emotion processing and interpersonal emotion transfer. Additional documentation of cross-channel contagion comes from Hietanen, et al., 1998.

Summary: Thus far, we have focused on reviewing the voluminous research documenting that people do indeed tend to mimic the facial expressions of others and that the feedback from such mimicry (and the resulting emotional contagion) provides valuable information as to others thoughts and feelings. In a recent survey of facial mimicry-contagion

research conducted since the previous research, Schneider (2008)

concluded:

> There is overwhelming evidence not only that viewing
> emotional facial expressions elicits facial expressions in the
> viewer (Blairy, Herrera, & Hess, 1999; Dimberg & Thunberg,
> 1998; Dimberg, et al., 2000; Hess and Blairy, 2001;
> Lundqvist & Dimberg, 1995; Sloan, Bradley, Dimoulas & Lang,
> 2002; Weyers Muhlberger, Hefele & Pauli, 2006; Wild, et al.,
> 2001) but that viewing emotional facial expressions elicits
> changes in emotional state (Blairy, et al., 1999; Hess & Blairy,
> 2001; Laird, Alibozak, Davainis, Deignan, Fontanells, Hong, et
> al., 1994; Lundqvist & Dimberg, 1995; Wild, et al., 2001).
> Furthermore, several studies have shown that the facial
> expressions elicited when viewing emotional faces are difficult
> to suppress (Dimberg, Thunberg, & Grunedal, 2002; Kappas,
> Bherer & Thériault (2000) (p. 8).

Sounds definitive . . . but science always moves on and what was

once so obvious becomes open to dispute. Let us now turn to a review

of the new directions that emotional contagion research has taken,

focusing on mimicry.

Recent Developments in Mimicry/Contagion Research:

Mimicry and Contagion in Social Context

Although mimicry and contagion are ubiquitous, theorists have

pointed out that culture, gender, and social context can enhance or

inhibit these processes. Evolutionary psychologists have argued that

mimicry serves the adaptive function of aiding social survival. According

to them, mimicry is a kind of social glue that binds people together (Chartrand et al., 2005; Lakin & Chartrand, 2003; Lakin, Jefferis, Cheng, & Chartrand, 2003).

Today, the scholars who are most systematically studying the impact of social factors on mimicry and emotional contagion are Ursula Hess and Agneta Fischer (2013, 2015), who take a cognitive approach to mimicry, arguing that it is a case of embodied simulation. They claim that:

> . . . emotional recognition naturally occurs within a social context. We suggest that emotional mimicry is related to the understanding of an emotion in context and is involved in regulating one's relation with the other person, rather than being the synchronization of individual muscle actions . . . In other words, emotional mimicry involves the interpretation of signals as *emotions,* conveying emotional intentions, in a specific context (pp. 144 and 146).

The authors review 40 socialpsychophysiological studies. Generally, in such studies researchers present a flash of a face (displaying, say, a happy or sad expression) and then measure, say, the viewers' zygomaticus major (happiness) or corrugator supercilii (sadness) activity. Although most critics would assume that in such traditional studies social context is entirely absent—challenging their contention that context is the *sine qua non* of mimicry—the authors argue that:

Finally, even in research in which contextual cues are not provided, as has been the case for most facial mimicry research, context information is necessarily implied because faces themselves implicitly provide social context by informing us about the social identity of the expresser (ethnicity age, gender, etc.). This categorization then activates stereotypic expectations regarding the person's likely emotional reactions.

Given such a generous definition of "context," it is almost impossible to imagine an emotional display that doesn't include information as to "context." In any case, the authors argue that whether or not mimicry occurs depends on: the stimulus's head orientation and gaze direction; his or her facial expressions, how positively the subject views the stimulus, how competitive they are, and how similar they are.

Recently an impressive array of excellent experiments have been conducted to determine what impact (if any) culture, gender, and social context have on various types of mimicry and contagion.[2] Sparked by current theories they have investigated such questions as:

- Are people in different cultures equally likely to mimic and catch others' emotions?

- What about men and women—do they differ in susceptibility to contagion?

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[2] Although this chapter is primarily concerned with *facial mimicry* and contagion, in this section—since the same sort of logic suggests that culture, gender, and social factors should affect mimicry of all types (including facial mimicry)—we will cite all potentially the relevant research here, regardless of the type of mimicry involved and regardless of how contagion (or the lack thereof) is assessed.

- Does a person's desire to affiliate with the stimulus person affect emotional contagion?

- Are the participants friends, strangers, or enemies? Are participants with people who are similar or dissimilar? Are they with people from an in-group or an out-group?)

- Who has power in the relationship? (The one sending the emotion or the one receiving it?)

- What is the goal of the interaction?

- How willing are the sender and receiver to have the other read his or her emotions? (Does one wish to communicate one's true thoughts and feelings or to mislead the other?)

All of these factors have been found to have an impact on mimicry (facial, vocal, and behavioral mimicry) and contagion (see Chartrand et al., 2005; Chartrand & Lakin, 2013; Hatfield et al., 1993).

Alas, once again whether these cultural, gender, and contextual factors shape not just mimicry and contagion (separately) but alter the precise nature of the relationship between the two, we do not know. The results of this research is suggestive but not definitive.

Culture. The spontaneous mimicry of facial expression and subsequent emotional contagion appears to be a cultural universal. Facial mimicry and emotional contagion have been observed in American, Finnish, Dutch, Western European, and Japanese participants as well as in participants from a number of other countries (Stel & van Knippenberg,

2008; Surakka & Hietanen, 1998; Tamura & Kameda, 2006).   Many theorists, however, have speculated that culture should have at least some impact on people's tendency to mimic others' facial expressions. They contend, for example, that people in individualistic cultures should be less prone to mimicry and contagion than are people in collectivist cultures (see Markus & Kitayama, 1991; Singelis, 1995, for an elaboration of this argument). Evidence in support of these reasonable sounding hypotheses is limited, however (again, see Singelis, 1995). Often no cultural differences are found.

Gender. Many theorists have proposed that women pay more attention to others' emotions, and thus are more susceptible to mimicry and emotional contagion than are men (Buck, 1984; Doherty, et al., 1995; Hall, 1978); Surakka & Hietanen, 1998). Alas, many other scholars have found *no* gender differences in susceptibility to mimicry and feedback; some even finding that men are more susceptible to facial mimicry and contagion than are women (La France and Ickes, 1981; Lundqvist & Dimberg, 1995). We have speculated that apparent gender differences may not necessarily be due to gender but to the type of stimuli that researchers typically employ in assessing mimicry and contagion. Often scholars show people, expressing strong emotion, as

they describe highly emotional events, and watch subjects' responses.

We know there are differences in men's and women's comfort with such

personal revelations. We speculated that if subjects were to watch a

sports event—with winners jubilant and losers heartbroken—gender

differences might reverse or even disappear. In two preliminary studies

using a sports setting we, in fact, found both men and women equally

susceptible to mimicry and contagion using such stimuli (Arakawa, 2012;

Thornton, 2013).

Power. Several scholars have speculated that the powerful have no

particular reason to care about the thoughts and feelings of their

subordinates; thus, they may pay little attention to them. Subordinates,

on the other hand, have every reason to be interested in discovering

what makes their superiors tick. Because they must understand those

with power over them if they are to win their favor, they pay close

attention to them. At the time of the Selma marches, Martin Luther King

expressed surprise that whites often had very little insight into the

thoughts, feelings, and experiences of blacks. Blacks *had* to know a

great deal about whites. Thus, theorists argue, the powerful should be

less likely to attend to, mimic their facial expressions, and share the

emotions of their inferiors. Researchers have assembled some evidence

that possessing power and being sensitive to others' feelings are negatively correlated (Hall, 1979; Snodgrass, 1985). In fact, however, power appears to have paradoxical effects on contagion (Carr, Winkielman, & Oveis, 2013; Hsee, et al., 1990), sometimes sparking nurturance, sometimes sparking exploitation. This, naturally, produces a different relationship between power, mimicry, and contagion (Hsee, et al., 1990). Clearly, subsequent research must investigate these factors.

Liking, Similarity, and Ingroup versus Outgroup Status. Recently theorists have come to realize the critical importance of liking, similarity, and ingroup versus outgroup status in influencing a wide range of social behavior. So too with mimicry and contagion. The consensus is that pre-existing rapport and/or a desire to affiliate (see Aylward, 2008, Bailenson & Yee, 2005; and Hess & Fischer, 2013, for a summary of this research), similarity (see Stockert, 1994, for a summary of this research), and group membership do indeed have a profound impact on mimicry and contagion (Chartrand & Lakin, 2013; Hess & Fischer, 2013; van der Schalk, et al., 2011). Yet, in our own work and that of our graduate students, we have come to recognize that these factors might be weaker than one might expect. Decade after decade we have tried to demonstrate that these factors matter (as logically it seems they must)

only to fail yet again to secure them in carefully crafted experiments (see

Aylward, 2008, and Stockert, 1994). After each failure, our designs

grew more complex and our research methodology more sophisticated . .

. to no avail. Our research group has never been able to demonstrate

that these factors matter.

Ideally, given the checkered history of research in this area,

scholars should collect examples of success and failure, and conduct

meta-analyses, to determine how important these factors are—if at all.

It seems that contagion is often simply too ubiquitous to be influenced

by such factors.

How Tightly Linked Are Mimicry and Contagion?

We began our paper by observing that emotional packages are

complex bio-behavioral systems, comprised of many components--

including conscious awareness, facial, vocal, and postural expressions;

neurophysiological and autonomic nervous system activity; and

instrumental behaviors—and that all may well contribute to emotional

experience. Different areas of the brain process the various aspects of

emotion. Yet, because the brain integrates the emotional information it

receives, each of the components acts on and is acted upon by the

others. Our definition of emotion, then, stresses the importance of *all*

the elements of an emotional "package" in shaping emotional experience and behavior. Which are most important in any given situation "depends."

Other researchers have been more ambitious. Brilliant logicians, possessing a vast knowledge of the scientific literature, have crafted creative experiments, using state-of-the-art techniques, in hopes of understanding the nature of emotion. (More than 4,000 studies have been conducted on the topic [Schneider, 2008]). They have speculated about the importance of various aspects of emotion, asking if a given component is a necessary cause, a sufficient one, or just a correlate? A first system or one of many? A conditioned response or an innate characteristic? Can scholars integrate all the existing theories—in sort of an Einsteinian Unified Theory of emotion? (See Schneider, 2008, and Whissell, 1985 for a discussion of these issues.)

As yet, however, no one has managed to provide a cognitive map through this maze. One of the oldest theories, dating from Aristotle, Spinoza, Descartes, and James) is the notion that people's emotions arise from a perception of their circumstances—be they delightful or dire. In more recent years, theorists have argued that "emotions consist of patterns of perception, or rather interpretation, and their correlates in the

central and peripheral nervous systems (see Ellsworth & Scherer, 2009, p. 572). Modern day theorists who have taken this approach include Ellsworth and Scherer (2009); Frijda (1986), and Lazarus (1966),

For other traditional arguments as to the primacy of one or another of these systems, and exactly how they interact, see: Kihlstrom, (2007: re: conscious/unconscious triggers of emotion); Winkielman and Schooler (2012: for the role of conscious awareness in emotional experience); Halberstadt, et al., (2009) and Schachter & Singer (1962: cognitive interpretations of ambiguous arousal); James (1890: visceral changes); Laird (1974: expressive muscular feedback); Bloch, Orthous, and Santibanez (1987: facial, breathing, and postural feedback); De Groot, et al. (2012: chemosignals); Zajonc, et al. (1989: venal blood flow to the brain); and Ekman, Levenson, & Friesen (1883: activities of the Autonomic Nervous System); among others. Of course, all of these theories have been subject to sharp critiques.

In 1923, Alfred North Whitehead and Bertrand Russell published their great *Principia Mathematica,* probably the most famous text ever written on the foundation of mathematics. In later years, in commenting on the mental labor required to craft the book, Russell confessed: "The difficulty and the labour were too great for any pleasure to be possible.

[M]y intellect never quite recovered from the strain." He admitted that during his labors he would stand on the footbridge at Kenningston, near Oxford, and feel close to putting himself under the trains. Twenty-five years later he remarked that, due to the level of concentration involved in writing *Principia*, he "had actually damaged his brain" (quoted in Blackwell, 1965, pp. 152-153).

In truth, that is how we feel when asked to answer a multitude of questions about the precise nature of the link between facial (and all other kinds of mimicry), feedback, and contagion of the various emotions. In our initial formulation, we defined primitive emotional contagion as:

> The tendency to automatically mimic and synchronize facial expressions, vocalizations, postures, and movements with those of another person's and, consequently, to converge emotionally.

We argued that cognitive processes plus cues from emotional contagion can provide immensely valuable insights into others' thoughts and feelings (Hsee, Hatfield, & Chemtob, 1992). About the importance of all possible causes of emotion, compared to the subtle running "print-out" of facial feedback, and the exact process of the facial mimicry, feedback, contagion process, as well as how all the various components of emotion interact, we had little to say. It simply seemed (and seems) too early to make a definitive statement. Today, however, other more intrepid

theorists are still boldly attacking the tough questions.

Hess and Fischer (2013) have long been interested in the impact of social context on facial mimicry. They focus on such antecedents as one's positive or negative attitude toward others (Are people in a relationship? Do they like one another? Is their relationship cooperative or competitive? Do they wish to affiliate?) Hess and Blairy (2001) argue that in everyday life, people's facial expressions are relatively weak and idiosyncratic and may not spark contagion. It is cartoons and staged, prototypic expressions that account for the mimicry-contagion link so often documented in the literature. (The reader may recall that we, like Sato, Fujimura, & Suzuki, 2008, take the opposite position, arguing that the more naturalistic an emotional expression, the more modalities in which the expression appears, and the more movement the person displays, the more powerful emotional contagion should be.

In one study, Hess and Blairy (2001) asked women to rate a series of short video clips of people expressing anger, sadness, disgust, and happiness. They found that while mimicry was robust (people mimicked the faces of people expressing anger, sadness, disgust, and happiness) and emotional contagion was prevalent (people were swept up in others' happiness and sadness), the link between the two (i.e., mimicry and

contagion) was tenuous. A meditational analysis found no link between mimicry and contagion. Why that is so, we do not know.

One problem is, of course, that in any small collection of studies we can never be certain if (in a given experiment) there is truly no correlation between two variables or if there were design or measurement flaws that accounted for the lack of results (see Cacioppo, et al., 2003 and Cumming, 2012, for a discussion of the statistical and methodological problems that plague emotion researchers). In the above case, how do we make sense of the fact that in, say, 50 experiments a brief flash of a face (say 300-400 msec of exposure: Dimberg & Thunbrg, 1998), produced mimicry and emotional contagion while in the 51st it did not? Were the 50 studies merely statistical artifacts (that may be the case, since only positive studies are published), or is it the single study that is more likely dubious? What about measurement errors? In a recent issue of *Emotion Review* (Russell & Harris, 2013), a plenitude of papers reported that in studying subjects' expressions of "basic emotions," the correlations between subjects' self-reports, experimenters' ratings, Ekman, Friesen, and Hager's (2002) FAC scores, fMRI measures, and the like were typically weak or non-existent. Given these difficulties, only more rigorous and fine-tuned research will answer the question as to what

is the exact link between mimicry and emotional contagion (see

Lundqvist, 1993 for a fine discussion of this argument.) Nonetheless, the

Hess and Fischer theory should certainly be added to all the other

theories we have just surveyed, which attempt to articulate the nature of

emotion.

A few other studies have also found that experimental stimuli (be

their faces, etc.) may produce only mimicry, only contagion, neither one,

or both. They also sometimes find mimicry/contagion for some

emotions and not for others (Blairy, Herrera, & Hess, 1999; Gross &

Levenson, 1993,1997; Gump & Kulik, 1997; Lundqvist, 1993). For an

extensive review of this research, see Hess and Fischer, 2015.)

We should note that some theorists go further than preceding

theorists in questioning the link between mimicry and contagion.   They

insist that, under the right conditions, people may mimic and "catch"

emotions very different from the ones that they are observing (Lanzetta

& Englis, 1989; Fischer & Hess, 2015). A few studies have even

demonstrated counter-mimicry. People may feel amusement when

another sobs dramatically, feel terrified with encountering an aggressive

thug in a dark alley, feel Schadenfreude when seeing an enemy suffering,

or be jealous when seeing a rival smirk in victory. In one study, for

example, participants who were engaged in a cooperative activity exhibited traditional mimicry while those who were competing exhibited counter-mimicry: they experienced joy at their rival's suffering (Lanzetta & Englis, 1989). Unfortunately, here again, we do not really know whether participants initially showed a flash of mimicry, while subsequently a recognition of the fulfillment (or thwarting) of their own selfish interests swept in and swamped the delicate moment-to-moment mimicry and primitive emotional contagion. . . or if they displayed counter-mimicry from the start. Again, only subsequent research will illuminate this process. That is what makes this whole area so exciting. There is much work yet to be done to settle these basic questions. Our best guess at the moment, however, is that facial, vocal, and postural mimicry generally produce emotional feedback that sparks contagion. In our own research, the link seems to be a powerful one.

Development of Standardized Materials for Sparking Mimicry-Contagion

One appealing development in mimicry/contagion research is the development of a standard set of stimuli for sparking mimicry/contagion. Thirty years ago, when we began research on mimicry/contagion, we wrote to many stars in the field to find out if

we could use their emotional stimuli. Generally, scholars such as John

Lanzetta informed us that they had used clips from popular movies or

some such. Looking at the clips the researchers provided, however,

we were dumbfounded to discover that they reflected a mish-mash of

emotions. Clips from *Five Steps,* for example displayed surprise, fear,

and anger. Later researchers tried to solve this problem by using

single faces, often based on Ekman's prototypes, or tapes of men and

women from various ages and ethnic groups describing their

emotional experiences, as their stimuli. In almost all cases, often

because of IRB strictures, these tapes are not available to other

researchers.

Recently, Skyler Hawk, Job van der Schalk, and colleagues (Hawk,

van Kleef, Fischer, & van der Schalk, 2009; van der Schalk, Hawk,

Fischer, & Doosje, 2011) attempted to remedy this defect, producing

standard stimuli for the various emotions: providing prototypic video

clips of faces and voices. These are now available from the first

authors (s.t.hawk@cuhk.edu.hk, VanderSchalkJ@cardiff.ac.uk).

For those who wish to minimize gender differences, clips of

ecstatic and disconsolate baseball audiences (using the finale of Game

6, of the 2011 World's series—a tremendously suspenseful game)

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Discoveries from New Disciplines, Utilizing New Technologies, for Establishing the Mimicry-Contagion Link

Recently, cognitive neuroscientists, chemists, and medical researchers have entered the debate as to the role of mimicry in mimicry/feedback/and contagion. They have used such traditional methods as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), or transcranial magnetic simulation (TMS), but increasingly psychopharmacological, psychoneuroendocrinological, and genetic methods to investigate the processes of contagion and empathy (Lamm & Silani, 2014). Their perspectives have greatly enhanced our understanding of these processes (see Hatfield, Rapson, & Le, 2009; Levenson, 1988).

Neuroscientists recently made a big splash with their discovery of mirror neurons and their role in emotion. Their discoveries provide some insight into why people may so readily "catch" the emotions of others and why it is so easy for people to be in sync with other people's thoughts, emotions, and behaviors. Neuroscientists point out that certain neurons (canonical neurons) provide a direct link between perception and action.

Other types of neurons (mirror neurons) fire when primates perform certain actions *and* when they observe other animals perform the same kinds of action.

Rizzolatti (2005) and his colleagues at the University of Parma, for example, monitored the brains of macaque monkeys as they watched another monkey performing an activity (grasping a peanut). They made a fascinating discovery: mirror neurons—a type of brain cell that responds the same way when monkeys (or humans) perform an action as when they merely witness another monkey (or human) performing the same action! Researchers have suggested that these brain structures may well be responsible for "mind-reading" (understanding the intentions of others), emotional contagion, and empathy in humans (see Blakemore & Frith, 2005; Glenberg, 2011; Iacoboni, 2005; Rizzolatti, 2005; Wild et al., 2003).

One important question pertains to the sequential order of mirror neuron firing and mimicry. Iacoboni and his colleagues contend that their monkeys were "doing nothing"—simply observing the other animal—when the mirror neuron firing occurred (see Iacoboni, 2005; Rizzolatti, 2005; Wild, *et al.,* 2001, 2003). We suspect that this may not be so. In films

of these sessions, it appears that at every instant, the primate was mimicking the stimulus person's (or monkey's) grasping action.

Depending on the timing, the mirror neuron firing may have *caused* the monkey's grasping OR the animal's mimicked grasping may have caused the neuronal firing. That is, the same brain areas may fire when an animal intentionally acts and when it performs the same action via mimicry. Only subsequent research will tell us which order is the correct one. Both processes, of course, would be of great interest to emotional contagion researchers.

Recently, other theorists (such as embodied cognition theorists) have suggested that the act of imagining, perceiving, or mentally representing a behavior will excite the motor programs necessary for the activation of that behavior, thus causing automatic imitation of that behavior (Blackemore & Frith, 2005; Chartrand et al., 2005; Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Jeannerod, 1994; Rizolatti, Fadiga, Fogassi, & Gallese, 1996). There is evidence that such automatic mimicry is innate (Field, Woodson, Greenberg & Cohen, 1982; Termine & Izard, 1988).

These "mirror neurons" also create interference in participants' behavior when participants are instructed to perform a contradictory

behavior while perceiving an incongruent behavior—for example when one is asked to shake one's head "No" while watching another person nod "Yes" (Brass, Bekkering, & Prinz, 2001; Craighero, Bello, Fadiga, & Rizzolatti, 2002; Kilner, Paulignan, & Blakemore, 2003).

Conclusions

The quest to discover the nature of emotion, facial, vocal, postural, and expressive mimicry has fascinated researchers since Darwin's time. An abundance of theories exist. Many of the theoretical and research questions have been debated. There is clear evidence that if participants are attending, emotional stimuli spark mimicry, feedback, and contagion. What is now in question is (1) Are their social and contextual factors that shape primitive emotional contagion, or does contagion always occur? Is it simply the fact that social and contextual factors shape subsequent emotion? (2) *If* social and contextual factors matter in shaping the prevalence and intensity of emotional contagion, what are the factors that matter? Are culture, gender, power, attraction, positiveness/negativeness of the relationship, familiarity, and motivations important precursors? How much do they matter? (3) What accounts for counter-contagion?

We have proposed that primitive contagion is always immediate and ubiquitous. It is simply the fact that *after an initial burst of mimicry/feedback/contagion,* appraisal processes and an awareness of one's own desires and motivations may then enter the picture and swamp (or reverse) primitive contagion?

We can only hope that the entry of scholars from a wide variety of disciplines, using a wide array of new techniques, can help answer these questions. One caveat: There is a tendency for researchers to be aware only of research done from their own perspective. It would be a tragedy if scholars ignored the wide array of carefully crafted research that that gone before and spent their time reinventing the wheel. In reading the hundreds of papers that we reviewed for this article, we have found that there is some evidence that new entrants into emotion research are guilty of neglecting their predecessors' work. It is hoped that review papers such as this one will give scholars the tools they need so that they can familiarize themselves with what has gone before and spend their intellectual capital and research energies on moving the field forward.

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