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Intragroup emotion convergence: Beyond contagion and social appraisal

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Abstract

Mimicry-based emotion contagion and social appraisal currently provide the most popular explanations for interpersonal emotional convergence. However, neither process fully accounts for intragroup effects involving dynamic calibration of people's orientations during communal activities. When group members are engaged in shared tasks, they simultaneously attend to the same unfolding events and arrive at mutually entrained movement patterns that facilitate emotional coordination. Entrainment may be further cultivated by interaction rituals involving rhythmic music that sets the pace for collective singing, dancing, or marching. These rituals also provide an emotionally meaningful focus for group activities and sometimes specifically encourage the experience of intense embodied states. Intragroup emotion convergence thus depends on interlocking processes of reciprocated and context-attuned orientational calibration and group-based social appraisal.

Intragroup Emotion Convergence: Beyond Contagion and Social Appraisal

When emotions are experienced and expressed in social contexts, they often induce similar emotions in other people. For example, when a person interacts with someone who is happy, excited, or anxious, it can make them feel happy, excited or anxious too (e.g., Hatfield, Cacioppo, & Rapson, 1994). When more than two people interact, the social consequences of their emotions can spread more widely into social networks and groups (e.g., van der Löwe & Parkinson, 2014), potentially leading to escalating effects. Being surrounded by other people sharing a common emotional outlook may in turn strengthen each group member's sense of solidarity and shared social identity, ultimately leading to genuinely collective emotions (e.g., von Scheve & Ismer, 2013). Thus, crowds of football supporters, or people taking part in political demonstrations sometimes seem to think, feel and act as one (e.g., Drury, Cocking, Beale, Hanson, & Rapley, 2005; Neville & Reicher, 2011).

Psychologists usually explain interpersonal emotional convergence by reference to two alternative processes (e.g., Parkinson, 2011). One involves automatic mimicry-based contagion (e.g., Hatfield et al., 1994) and the other involves appraising what is happening in the light of someone else's emotional orientation (*social appraisal*, Manstead & Fischer, 2001). This paper evaluates how well these explanations account for convergent emotions in groups of more than two people. For example, does the emergence of collective emotion depend simply on a concatenation of interpersonal effects or are genuinely group-level processes implicated? I argue that social appraisal operates differently when the normative implications of group membership come into play. Further, group-based social appraisal is supplemented and supported by a more dynamic and embodied process of orientational calibration that can lead to distinctively collective effects. Group members adjust to each other's evolving stances to temporally

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3 structured group events and their emergent collective emotion is further sustained by the shared
4 sense of involvement in meaningful social action.
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8 The paper is organized as follows. In the first section, I consider three processes that
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10 potentially underlie emotional convergence at the interpersonal level, including not only
11 mimicry-based contagion and social appraisal, but also a distinctive form of dynamic and
12 reciprocal relation alignment involving orientation calibration, which allows emotional influence
13 to begin before any categorical emotional state has consolidated. In the paper's second section, I
14 evaluate evidence for the operation of mimicry-based contagion, social appraisal and
15 orientational calibration in intragroup contexts. I argue that there is little empirical support for
16 the operation of mimicry-based contagion but that group-based social appraisal and orientation
17 calibration both contribute to documented examples of intragroup emotion convergence, either
18 singly or in combination. In the paper's third section, I consider how collective practices such as
19 interaction rituals facilitate the operation of group-based social appraisal and orientation
20 calibration and suggests ways in which these processes might interact in mutually reinforcing
21 ways. I conclude that group emotions often arise from the sense of shared identity and collective
22 efficacy that emerges when interacting individuals are commonly oriented to temporally
23 structured activities in a shared space.
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42 **Explaining Interpersonal Emotion Convergence**

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44 This section distinguishes three processes that potentially explain why people's emotions
45 might converge with each other over time. Mimicry-based emotion contagion involves a form of
46 automatic interpersonal transfer of the experiential quality of emotion regardless of its object-
47 orientation. Social appraisal implies that a person takes account of someone else's emotional
48 orientation when appraising an object, person or event. Orientational calibration proposes that
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3 two or more people's directed attentional activity and bodily movements become aligned in a
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5 process of reciprocal adjustment. I argue that the evidence for mimicry-based contagion is
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7 limited, that social appraisal can explain some but not all cases of interpersonal convergence, and
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9 that orientational calibration represents an under-explored supplementary mechanism that can
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11 explain cases of mutual coordination that do not depend on explicit communication of
12
13 categorical information about emotion.
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16 17 **Emotion contagion** 18

19 Contagion has been a popular notion for more than a century (e.g., Le Bon, 1895), but as
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21 yet there is little consensus about its definition. Some researchers use the concept in a purely
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23 descriptive sense as a name for the phenomenon of emotional convergence, regardless of why it
24
25 might happen (e.g., Elfenbein, 2014; Wróbel & Imbir, 2019). Others treat contagion as a more
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27 specific process that potentially explains that phenomenon. For example, van Kleef (2009)
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29 argues that emotional contagion provides a non-inferential route to emotional influence, and
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31 Parkinson (2011) proposes that contagion implies emotional convergence that operates
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33 independent of the emotion's object-directedness. Thus, contact with someone who is anxious
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35 may induce convergent anxiety without any consideration of what they might be anxious about
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37 (e.g., Parkinson & Simons, 2012). Because the word "contagion" ordinarily implies catching
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39 something inherently infectious as a result of simple proximity, the process is usually thought to
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41 operate automatically and without any need for conscious thought (e.g., Le Bon, 1895).
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47 An influential explanation for this kind of automatic convergence was first developed in
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49 the early twentieth century by Lipps (1907), whose central interest was "einfühlung" (usually
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51 translated as "empathy"). Lipps focused on the question of how humans come to perceive the
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53 movements of other people's bodies and faces as expressions of underlying emotions, thus
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3 facilitating a sense of psychological rather than merely physical contact. What makes us feel that
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5 there is something deeper and more meaningful behind the superficial muscular twitches that we
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7 see on someone else's face? According to Lipps, the answer is that we engage in a form of
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9 projective identification, recreating the other person's experience internally and then attaching it
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11 to our perception of their bodily movements. In other words, how we see the other person is
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13 colored by our own private simulation of what they are feeling. Such an empathic process can
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15 only work if we first conjure up a matching experience in ourselves. According to Lipps,
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17 achieving this involves automatically moving our own bodies in similar ways to the other person
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19 and registering how that makes us feel. Empathy therefore depends on a prior process of
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21 contagion.
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26 Hatfield, Cacioppo and Rapson's (1994) primitive emotional contagion (PEC) model
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28 provides a more precise specification of this prior process. According to PEC, individuals
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30 automatically mimic each other's facial and bodily movements (e.g., Meltzoff & Moore, 1977)
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32 and the interoceptive feedback from their mimicked responses in turn generates matching
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34 emotions according to the principles of James's (1884) peripheral theory. The PEC process thus
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36 breaks down into two stages, the first involving person B's mimicry of person A's expressions
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38 and the second involving Person B picking up A's emotion from the afferent signals provided by
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40 their own imitative movements (see Figure 1). Thus, the sensations produced by smiling in
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42 response to someone else's smile are thought to produce a happy experience.
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47 How good is the evidence for the PEC model? Many of the supportive studies show that
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49 other processes such as social appraisal do not fully explain emotional convergence but offer no
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51 positive evidence for the operation of the postulated mimicry-feedback process (e.g., Parkinson
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53 & Simons, 2009; Totterdell, 2000). The few experiments that have directly assessed underlying
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3 mechanisms have typically yielded negative results. For example, mimicry does not seem to
4 mediate effects of interpersonally perceived emotional expressions on experienced emotion (e.g.,
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6 Blairy, Herrera, & Hess; 1999; Gump & Kulik, 1997; Hess & Blairy, 2001).
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10 Neither mimicry nor feedback seems to yield strong or reliable enough effects to generate
11 the kinds and levels of contagion that are postulated by proponents of PEC theory in any case
12 (Parkinson, 2011). There is some evidence for spontaneous mimicry in both infants (e.g.,
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14 Meltzoff & Moore, 1977, but see Oostenbrook et al., 2016) and adults (e.g., Chartrand & Bargh,
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16 1999), but its frequency is too low to support a consistent contagion process. In Chartrand and
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18 Bargh's (1999) experiment 1, for example, participants rubbed their faces on average 2.2 times
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20 more often over a ten-minute period (i.e., 0.22 times per minute) when exposed to confederate
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22 who continuously modelled face-rubbing than when exposed to a confederate who continuously
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24 modelled foot-shaking.
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31 When emotionally significant movements are modelled, mimicry seems to depend on
32 prior apprehension of their meaning rather than being a direct reaction to their physical qualities
33 (Hess & Fischer, 2013). For example, Halberstadt, Winkielmann, Niedenthal, and Dalle (2009)
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35 showed participants a series of morphed faces that mixed together smiling and scowling
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37 configurations in equal proportions, thereby producing an emotionally ambiguous expression.
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39 During phase 1 of the study, these blended expressions were associated with either the word
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41 "happy" or the word "angry." In phase 2, the same facial stimuli were presented in the absence
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43 of any disambiguating emotion word. Measurement of participants' facial muscle activity
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45 revealed that there was significantly greater tension in the brow-lowering muscle (corrugator)
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47 while viewing faces that had been previously associated with the "angry" label. Thus,
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49 participants produced a key component of an "angry" expression when presented with a stimulus
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3 face that they perceived as angry, but not when they perceived it as happy. Findings such as this
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5 strongly suggest that emotional mimicry depends on a prior implicit interpretation process rather
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7 than direct matching of movements, thus rendering any subsequent simulation of the associated
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9 emotional state (e.g., Lipps, 1907) redundant.

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12 Reported effects of facial and postural interoceptive feedback on emotional experience
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14 are at best weak too (Cole, Larsen, & Lench, 2019). For example, meta-analysis of 17
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16 independent replications of Strack, Martin, and Stepper's (1988) influential study yielded a mean
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18 difference between conditions of 0.03 on a 10-point rating scale representing amusement
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20 (Wagenmakers et al., 2016). Another limitation is that most studies have compared conditions in
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22 which participants are made to produce expressions of contrasting valences (e.g., negative vs.
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24 positive expressions, Laird, 1974), meaning that the findings may only reflect the relative levels
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26 of pleasure produced by the manipulations and not the specific nature of any associated emotion
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28 (e.g., Winton, 1986). Explanations in terms of effortfulness or comfort of holding the face or
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30 body in a certain position therefore remain viable. Studies that compare the effects of producing
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32 expressions associated with different negative emotions (e.g., "sad" vs. "fearful" faces,
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34 Tourangeau & Ellsworth, 1978) often find non-significant differences in participants' self-
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36 reports and physiological responses.
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43 Even if facial feedback produced stronger and more consistent effects, could it provide
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45 the kind of interoceptive signal that might be sufficient to generate a specific emotional
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47 experience? It remains unclear what aspects of perceived bodily response would be capable of
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49 directly inducing pleasure or displeasure or the motivational impulses usually associated with
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51 qualitatively distinct emotions (Reisenzein & Stephan, 2014). Indeed, many theorists deny that
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53 emotional experience can be reduced to the detection of emotion-matching internal symptoms in
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3 the first place (e.g., Frijda, 1986). Feeling one's body react in a way that corresponds to a
4 particular emotion may well tell you that you are experiencing that emotion, but that self-
5 perception alone does not seem sufficient to generate the emotion itself.
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10 Facial and postural movements probably could not provide sufficiently diagnostic
11 information about specific emotions anyway. Durán, Reisenzein, and Fernández-Dols' (2017)
12 meta-analysis of laboratory and field studies suggested that the facial configurations predicted by
13 Ekman's (1972) neurocultural theory are produced in only around a quarter of sampled
14 emotional situations. This level of association makes it unlikely that self-perception of facial
15 signals (or even the neural motor codes that activate them, e.g. Neumann & Strack, 2000) can
16 provide any clear indication of what emotion a person might be experiencing.
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26 None of this means that interoceptive cues play no role in perceptions and self-
27 perceptions of emotion. One possibility is that registering dynamic changes in the face and
28 body's combined orientation to what is happening provides a more diagnostic specification of
29 the person's specific emotional stance (cf. Aviezer, Trope, & Todorov, 2012). More generally,
30 interoception may combine with exteroception to generate emotionally meaningful but context-
31 dependent representations (e.g., Barrett, 2017). In either case, PEC could not work purely on the
32 basis of internally registering what the face and body are doing.
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42 A final issue is that PEC cannot easily account for the selective operation of emotion
43 convergence in certain kinds of social situations but not in others. For example, a number of
44 studies suggest that people are more likely to mimic the expressions of friends and ingroup
45 members than strangers and outgroup members (e.g., Bourgeois & Hess, 2008, see Wróbel &
46 Imbir, 2019, for a review). One possible explanation for this selectivity is that emotions spread
47 when people are already inclined to align with each other's emotional orientations because of
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3 their affiliative motives or shared social identity (e.g., Hess & Fischer, 2013). In other words, it
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5 is not the perceptual characteristics of emotion expressions that underlies convergence but their
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7 meaning in the specific social context in which people interact. This context-dependence of
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9 emotional convergence is better explained by accounts based on social appraisal to which we
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11 now turn.

12 13 14 **Social Appraisal**

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17 The PEC model contends that convergent emotions are caused by interoceptive signals
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19 according to the principles of peripheral feedback theory (e.g., James, 1884; Laird & Bresler,
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21 1992). By contrast, social-appraisal accounts (e.g., Manstead & Fischer, 2001) adopt appraisal
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23 theory's general assumption that emotions depend on evaluation and interpretation of something
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25 occurring outside the body (e.g., Lazarus, 1991). From this perspective, events in the mental,
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27 physical, or social world need to be appraised as personally significant before they can produce
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29 an emotional response.

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33 How might someone else's emotion affect appraisal processes? According to Campos
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35 and Stenberg (1981), individuals appraise other people's responses to objects and events in
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37 addition to directly appraising those objects and events themselves. Social appraisal, then,
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39 involves arriving at an appraisal of what is happening partly on the basis of other people's
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41 responses to it. Sorce, Emde, Campos, and Klinnert's (1985) study of social referencing
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43 illustrates the operation of such a process. Each toddler taking part was separated from an
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45 attractive toy by a vertical precipice covered by thick glass (visual cliff). The floor in front of
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47 them became visibly lower but was actually safe to cross. The precipice was not deep enough to
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49 scare the toddler off, but also not shallow enough to be ignored. From the other side, the
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51 toddler's mother either smiled back or showed a fear face. All toddlers crossed the cliff towards
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3 their mother when she smiled, but very few ventured out across the glass when confronted by
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5 their mother's fear expression. Thus, the mother's apparent emotion changed the toddler's
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7 orientation to the visual cliff, making them either more or less willing to crawl onto it. When she
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9 expressed fear, the toddler decided at some level that moving onto the glass was too dangerous to
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11 risk. Because the mother apparently appraised the cliff as threatening the toddler started to see it
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13 as more threatening too. More generally, other people's emotions can indicate how to appraise
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15 objects or events, thus indirectly leading our emotions to converge with theirs.
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19 Social-appraisal processes need not involve the kind of explicit information-seeking and
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21 emotional communication that characterize social referencing (e.g., Clément & Dukes, 2017).
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23 They can also operate when there is no direct interaction between people and no prior intention
24
25 to clarify the emotional meaning of what is happening. For example, Repacholi and Meltzoff
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27 (2007) showed that toddlers who observed a stranger express anger rather than neutrality when
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29 the experimenter played with a novel object subsequently touched that object for relatively
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31 briefer durations. This effect of "emotional eavesdropping" also qualifies as social appraisal
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33 because the child's appraisal of the object depended (at least partly) on their perception of
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35 another person's apparent emotional orientation to it.
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40 There are at least two possible reasons for taking other people's emotional responses into
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42 account when appraising objects. The first is that they provide information about practical
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44 aspects of what is happening that might be unavailable from other sources (e.g., Bruder, Fischer,
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46 & Manstead, 2014). For example, toddlers in Sorce and colleagues' (1985) study wanted to
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48 know whether the visual cliff represented a barrier to attaining their goal and deferred to their
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50 mother's apparent appraisal of it as dangerous or safe. Second, other people's emotion may
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52 indicate the socially appropriate or normative way of responding to an object. For example,
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3 toddlers in Repacholi and Meltzoff's (2007) study may have concluded that touching a toy that
4 produced an angry response from a stranger would make them susceptible to disapproval from
5 other people. Similarly, Manstead and Fischer (2001) suggest that a person may be less amused
6 by a politically incorrect joke when someone else seems offended by it. In many cases, social
7 appraisal takes into account both practical and normative considerations simultaneously. For
8 example, toddlers may refrain from crossing a visual cliff because their mother's apparent fear
9 not only suggests that it may be dangerous but also implies that she does not want them to move
10 further forwards. As we shall see later in the paper, normative considerations may play a more
11 prominent role in intragroup contexts when appraising objects in the light of other ingroup
12 members' emotional orientations.
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26 PEC implies that emotion convergence depends simply on access to another person's
27 expressions regardless of where those expressions might be directed or what they might be about
28 (Parkinson, 2011). By contrast, the social-appraisal account of emotional convergence applies
29 specifically to contexts where two (or more) individuals orient to the same person, object or
30 event in the shared environment. Indeed, evidence from social referencing studies show that
31 adult emotions affect the toddler's behavior towards the particular object at which those
32 emotions are directed and not other objects (e.g., Feinman & Lewis, 1983; Hornik, Risenhoover,
33 & Gunnar, 1987), making object-independent contagion an unlikely explanation.
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45 Which dimensions of appraisal does social appraisal affect? According to Lazarus (1991,
46 see also Smith & Lazarus, 1993), primary appraisals of the direct personal significance of events
47 (their capacity to impede or facilitate our goals and concerns) may be distinguished from
48 secondary appraisals of the capacity to cope practically and emotionally with what is happening.
49 Primary appraisals determine the resulting emotion's intensity and valence whereas secondary
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3 appraisals determine its specific quality (e.g., as anger rather than fear). Other people's emotions
4 may affect both forms of appraisal (see Table 1). In particular, the mere fact that someone else is
5 orienting emotionally to something may signal that it is potentially motivationally relevant for us
6 too (e.g., Shteynberg, 2010), increasing our general tendency to react to it emotionally (e.g.,
7 Shteynberg et al., 2014). Further, the perceived level of their pleasure indicates the extent to
8 which they find it motivationally congruent, which may suggest that it is also motivationally
9 congruent for us if the other person is a friend or ally (or motivationally incongruent for us if
10 they are an enemy or competitor, e.g., de Melo, Carnevale, Read, & Gratch, 2014). Finally, their
11 expression of a specific pleasant or unpleasant emotion may tell us how they appraise their
12 coping potential and what conclusions they draw about their own and other people's
13 accountability, leading us to make similar or contrasting judgements ourselves.

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How exactly does the process of social appraisal operate? One influential account contends that explicit inferences about the implications of a perceived emotion are involved. In other words, people draw on the appraisal-related information provided by someone else's emotion when working out how to make sense of what is happening. For example, Hareli and Hess (2010) argue that people's knowledge of the appraisals that lead to specific emotions allows them to work out how another person must have interpreted and evaluated what happened in order to produce the emotion they are evidently experiencing. For example, seeing that someone else is angry may lead you to conclude that they blame someone else for what is happening to them. Thus, you work backwards from an observed emotion to infer what specific appraisal must have caused it. This "reverse-engineering" (or "backtracking," Elfenbein, 2007) process may result in perceivers changing their own appraisal of the emotional object or its normative implications and consequently experiencing convergent emotions (see Figure 2).

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3 There is good evidence that cognitively demanding inferential processes mediate some
4 reported interpersonal effects of emotion. For example, van Kleef, van den Berg, and Heerdink,
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6 2015) showed that participants' evaluations of a proposal to introduce a new Olympic sport
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8 converged with the perceived emotional expression of an apparent expert only in a low cognitive
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10 load condition. Further, Hareli and Hess (2010) demonstrated that perceived appraisals mediated
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12 the effects of a stimulus person's emotions on participants' personality judgements. However,
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14 social appraisal may also operate at a less explicit level. For example, Mumenthaler and Sander
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16 (2015) showed that participants judged a target face as more fearful when a subliminally
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18 presented peripheral face showed an angry expression with gaze directed at the target but not
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20 when the peripheral face's gaze was directed away from the target. In other words, participants
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22 apparently registered the implications of person-directed anger at some level without even being
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24 aware that they had seen an angry face (see also Bayliss et al., 2007).
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31 Outside the laboratory, it is relatively rare to receive a one-shot unidirectional
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33 communication indicating that someone is angry or fearful about something. Studies that have
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35 assessed emotion convergence in more interactive contexts often find interpersonal effects that
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37 are not mediated either by inferences about the other person's appraisals (e.g., Parkinson, Phiri,
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39 & Simons, 2012) or by explicit self-reported appraisals (e.g., Bruder, Dosmukhambetova, Nerb,
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41 & Manstead, 2012). For example, Parkinson and Simons (2009) used diary methods to
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43 investigate the interpersonal transfer of anxiety about everyday decisions. Participants reported
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45 greater anxiety about decisions when a close other also reported being anxious, but the
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47 interpersonal effect was not fully mediated by self-reported risk appraisals and remained
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49 significant even after controlling for participants' explicit perceptions of the other person's
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51 anxiety. In other words, decision-focused anxiety apparently had convergent interpersonal
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3 effects even when participants were not explicitly aware that anxiety was being expressed by the
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5 other person. One possible conclusion is that interpersonal responses to other people's emotions
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7 depend on explicit inferences to a lesser extent in contexts where there is ongoing interaction
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9 between people. When there is direct contact with someone else who is also orienting to the
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11 same emotionally relevant event, non-inferential processes may come into play, not all of which
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13 necessarily qualify as social appraisal (Parkinson, 2019).
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16 17 **Orientalional Calibration**

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19 Social appraisal involves arriving at a personal appraisal after factoring in information
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21 about another person's orientation to what is happening. In this section, I propose that people's
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23 orientations may also become more calibrated as a consequence of lower-level processes that do
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25 not involve registering information about someone else's specific object-directed emotion.
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27 Instead, separate aspects of person A's emotional orientation may bring separate effects on
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29 person B's orientation. For example, another person's shifting gaze may orient us toward a
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31 previously undetected stimulus (e.g., Driver et al., 1999) or the force of someone else's push may
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33 induce our direct muscular resistance. Further, there is evidence that people automatically
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35 synchronize the rhythm and tempo of their movements with those of other people (interpersonal
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37 entrainment, e.g., Bernieri, Reznick, & Rosenthal, 1988; McGrath & Kelly, 1986). When
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39 interpersonal processes such as this operate reciprocally, each interactant may be gradually
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41 nudged into a more structured emotional position without ever picking up the appraisal-related
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43 implications of what the other person is feeling or doing. Thus, convergent emotional
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45 orientations may consolidate from reciprocal adjustments rather than from private appraisals
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47 about the emotional meaning of someone else's stance towards an object. This dynamic and
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49 socially distributed process of orientational calibration is depicted in Figure 3.
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3 Most studies of social appraisal present participants with facial expressions or verbal
4 statements that are specifically intended to convey emotional meanings corresponding to familiar
5 emotion categories. In early social referencing experiments, for example, mothers were
6 explicitly trained to display either a prototypical fear face or a happy smile (e.g., Sorce et al.,
7 1985). Similarly, investigations of social appraisal in adults have typically presented participants
8 either with standardized facial stimuli representing basic emotions (e.g., van Kleef et al., 2015)
9 or with explicit verbal statements about a target's emotional experience (e.g., Hareli & Hess,
10 2010). Thus, the research implicitly presupposes that the starting point of any emotional
11 influence process is the direct communication of a categorical emotional meaning (e.g., as
12 conveyed by a face or verbal statement conveying fear, anger or sadness). Participants then pick
13 up on this meaning and use it as a basis for inference. In other words, the methodology of these
14 studies specifically encourages participants to engage in reverse engineering.

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31 When emotion-related stimuli are presented less explicitly, interpersonal effects are more
32 likely to depend on lower-level cuing processes. For example, Lee, Susskind, and Anderson
33 (2013) showed that participants were better able to detect gaze direction from schematic pictures
34 of eyes taken from a canonical "fear" expression than from pictures of "neutral" or "disgusted"
35 eyes. The main reason is that "fearful" eyes widen, making the sclera more visible. Inversion of
36 these eye stimuli reduced participants' perceptions of their fearfulness but did not interfere with
37 detection of gaze direction. In other words, gaze could be tracked more accurately from widened
38 eyes, independent of their perceived emotional meaning. Widened eyes also improved
39 discrimination of peripheral stimuli appearing in places where their gaze was directed.

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51 Table 2 sets out how orientational calibration may result in effects that parallel social
52 appraisal's consequences for different appraisal dimensions. For example, Lee and colleagues'
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3 findings suggest that the widened eyes directed at a particular object may cue responses that are
4 analogous to implicit appraisals of motivational relevance. People direct their attention to things
5 that other people seem to be orienting to (e.g., Driver et al., 1999), and this may lead to
6 emotional responses further downstream. Further, emotional orientations to motivationally
7 congruent objects tend to involve approach movements whereas emotional orientations tend to
8 involve avoidance or withdrawal. In each case, another person's attention and behaviour to what
9 is happening in the shared environment may adjust so that they align with the corresponding
10 orientations.
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21 Dynamic movements and patterns of eye gaze that are attuned in real time to unfolding
22 situations are potentially capable of inducing more articulated interpersonal effects. Their
23 cumulative pushes and pulls ultimately impose a dynamic pattern on the other person's
24 responses. For example, object-directed movements with smooth or jerky temporal profiles may
25 entrain correspondingly relaxed or agitated orientations from others (McGrath & Kelly, 1986).
26
27 When two people are jointly performing collaborative tasks, the temporal structure of those tasks
28 may help them align to each other too. For example, dancing together may facilitate the
29 consolidation of common rhythms of attention and movement (e.g., Reddish, Fischer, &
30 Bulbulia, 2013, and see below).
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42 The orientational calibration effects shown in Table 2 suggest that different aspects of a
43 person's embodied orientation to an object or event in the shared environment may separately
44 influence different aspects of another person's orientation. However, it is important to note that
45 the physical and temporal characteristics of these orientations cannot specify the nature of any
46 emotional quality in isolation. It is the relation between a person's movements and what is
47 happening around them that gives these movements their emotional character. For example,
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3 patterns of anxious withdrawal will differ depending on whether the environment affords hiding
4 from another person instead of running away. Unlike PEC, then, the orientational-calibration
5 explanation of interpersonal convergence does not assume that interoceptive signals are
6 diagnostic of distinctive emotional experiences. Indeed, being emotionally oriented to events
7 need not involve any internal registration of emotional quality in any case (e.g., Frijda, 2005;
8 Lambie & Marcel, 2002).

17 **Section Conclusions**

19 In this section, I have distinguished three kinds of processes potentially underlying
20 interpersonal emotion convergence. To summarize, emotion contagion involves automatic
21 transmission of emotional quality from person to person independent of any object-directedness
22 of the source's affective state, social appraisal involves appraising what is happening partly on
23 the basis of information about someone else's perceived emotional orientation to it, and
24 orientational calibration involves mutual adjustment of changing attentional focus and dynamic
25 embodied stances in relation to unfolding events (see Table 3 for a schematic representation of
26 these differences).

28 Although orientational calibration and social appraisal are conceptually distinct, Table 3
29 makes it clear that the processes share a common dependence on the object-directedness of
30 emotions. They both serve the more general function of relation alignment (Parkinson, 2008), by
31 facilitating the interpersonal coordination of emotional orientations to what is happening. This
32 raises the possibility that social appraisal and orientational calibration may work together as well
33 as separately. For example, objects that are cued by someone else's gaze might provoke a more
34 explicit process of social referencing that further clarifies their implications for appraisal. As
35 emotional orientations consolidate, individuals may also start to register the implications of each

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3 other's stance for their own appraisal thus producing more explicit emotionally convergent
4 effects (see Figure 4). Additionally, it is possible that developing emotional orientations have
5 parallel effects on both interpersonal adjustments and inferential processes. Thus, a person may
6 simultaneously respond to the sensory force of an angry shove or shout and to its blame-directing
7 meaning. In these cases, orientational calibration can underwrite and reinforce the pragmatic
8 impact of an emotional communication that also carries semantic implications. One of the
9 reasons that expressed anger serves as a threat is that it is backed up by an evident readiness to
10 push against the obstruction on which it is focused.

11
12 Despite the frequent mutual interdependence between social appraisal and orientational
13 calibration, the latter process often takes precedence during early stages of emotion convergence
14 before any articulated emotional meaning consolidates. In some cases, an entire interpersonal
15 emotional episode may even unfold without either party registering the relational meaning of
16 their own or the other party's emotions, making the operation of inferential forms of social
17 appraisal unlikely.

18
19 In the next section, I review research that potentially supports the operation of emotion
20 contagion, social appraisal and orientational calibration in intragroup rather than dyadic contexts.
21 I will argue that neither mimicry-based emotion contagion nor inferential social appraisal is
22 capable of accounting for the full range of documented cases of intragroup emotional
23 convergence. However, combining social-appraisal and orientational-calibration processes
24 permits a more comprehensive understanding.

25 26 27 **Explaining Intragroup Emotion Convergence**

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29 At one level, a group is simply a collection of more than two individuals. However,
30 group processes depend not only on the increased possibilities for interpersonal influence arising
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3 from greater numbers of interacting individuals but also on the capacity to develop distinctive
4 social identities, shared practices, and collective norms. Group members orient to objects and
5 events that have shared significance and that respond to their combined team-work. These
6 factors also transform the operation of processes that contribute to emotional convergence
7 between group members. In this section, I review research addressing the consolidation of
8 group-based emotions and consider the extent to which explanations of interpersonal emotion
9 convergence can be extended to accommodate them.

19 **Intragroup Contagion**

21 Intragroup contagion involves object-independent automatic convergence of group
22 members' emotions. Since the time of Le Bon (1895), theorists have resorted to this concept to
23 explain the supposedly irrational behaviour of large collections of co-present individuals such as
24 crowds ending up in states of mass panic (see von Scheve & Ismer, 2013 for a review; and
25 Reicher, 1987, for a critique of the irrationalist account). However, most studies that investigate
26 intragroup contagion focus on smaller numbers of interacting individuals.

35 Barsade (2002) presented evidence consistent with the operation of multi-person PEC in
36 an organizational context. Participants in her study played the role of managers who each made
37 their case for awarding a bonus to a specific nominated employee during a simulated team
38 meeting. The first person to take their turn in the discussion was a male drama student (serving
39 as the experimenter's confederate) who adopted one of four emotional styles involving pleasant
40 or unpleasant affect combined with either high or low energy. For example, in high-energy
41 conditions, the confederate made frequent eye contact, spoke with a strong voice and sat straight
42 in his chair, and in pleasure conditions, he smiled frequently. Participants' self-reported and
43 video-coded affective state improved most in conditions where the confederate presented

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3 pleasant affect (regardless of the manipulated level of energy). In other words, the valence of
4
5 participants' emotional reactions tended to converge with the confederate's expressed affect over
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7 the course of the discussion. Participants' task performance was also superior in this pleasure
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9 condition.
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12 PEC is clearly one potential explanation for these findings. However, it is also possible
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14 that participants simply used the confederate's affective style as a guide to how they should act
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16 in this relatively unfamiliar social situation. In other words, the first speaker may have
17
18 established an affective norm for group members (Barsade & Gibson, 1998) much as leaders set
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20 the emotional tone for subordinates to follow (e.g., Sy, Côté, & Saavedra, 2005; van Kleef,
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22 Homan, Beersma, & van Knippenberg, 2010). Thus, participants may have appraised the
23
24 requirements of the task in ways that factored in the confederate's apparent emotional
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26 orientation. Alternatively, exposure to a smiling and apparently happy confederate may simply
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28 have contributed to the pleasantness of the situation for participants.
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33 Several other studies have also shown that the affective states of people working in
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35 groups are often interlinked (e.g., Bartel & Saavedra, 2000; George, 1990; Totterdell, Kellett,
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37 Teuchmann, & Briner, 1998). For example, Totterdell (2000) found that members of a British
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39 professional cricket team tended to share similar levels of happiness at different stages of a four-
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41 day match. At each time point, the aggregated affective state of the team predicted individual
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43 players' affect, which in turn influenced performance in the game. Players who reported higher
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45 levels of susceptibility to emotion contagion (Hatfield et al., 1994) were affected relatively more
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47 by other players' affective states, consistent with the PEC account. Further, affective similarity
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49 between players on each team could not be fully explained either by commonly experienced
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3 hassles or levels of performance during the match, suggesting that contact with other team
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5 members rather than parallel appraisal processes led to the reported emotional influence.
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8 Although Totterdell's study provides a compelling example of emotional convergence
9
10 when team members work together over extended periods, realistic settings such as this do not
11
12 permit experimental or statistical control of all potentially influential variables. This means that
13
14 the findings cannot rule out the impact of other unmeasured aspects of team functioning such as
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16 team coordination, collective flow (e.g., Csikszentmihályi, 1990; Páez, Rimé, Basabe,
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18 Włodarczyk, & Zumeta, 2015, and see below), or emergent emotion norms (e.g., Delvaux et al.,
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20 2015, and see below) on convergent affect or improved performance. Given the lack of evidence
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22 for processes supposedly underlying PEC documented above, there remain serious questions
23
24 about whether intragroup convergence can really operate without some calibration of group
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26 members' orientations towards whatever is going on around them.
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30 31 **Intragroup Social Appraisal**

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33 **Group-based appraisal.** Appraisal theories argue that emotions depend on perceiving
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35 the relevance of objects or events to personal concerns (e.g., Lazarus, 1991). Unless what is
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37 happening makes a difference to what we want for ourselves, there is nothing to get emotional
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39 about. However, we clearly have a personal stake in other people's lives as well as our own, so
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41 emotions need not always depend on direct self-relevance.
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45 Members of our ingroup often matter to us most. We care about whether the sports team
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47 or political party we support prospers or suffers, and our emotions respond accordingly. Perhaps
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49 the most influential account of how group affiliation impacts on group members' behaviour and
50
51 experience is based on social identity theory (Tajfel & Turner, 1972) and its descendant self-
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53 categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). According to both
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1 theories, associating the self with a group aligns the person's own priorities with those of other
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3 group members and motivates that person to promote relevant group concerns. When we
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5 categorize ourselves in terms of an ingroup social identity, this tends to make us see things from
6
7 the group's perspective too.
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12 E. Smith (1993) developed an appraisal-based account of group emotions by extending
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14 these general principles. He argued that objects and events may accrue significance because of
15
16 their relevance to a currently salient social identity and not just an individual's personal identity.
17
18 In other words, people appraise things as congruent or incongruent with the goals and
19
20 motivations of the groups with which they identify, and this leads to group-based emotional
21
22 responses (E. Smith, Seger, & Mackie, 2007). Consistent with this account, several studies have
23
24 shown that group members respond emotionally to events that affect other members of their
25
26 group, even when those events do not affect them personally in any direct way (e.g., Kuppens,
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28 Yzerbyt, Dandache, Fischer, & van der Schalk, 2013; Yzerbyt, Dumont, Wigboldus, & Gordijn,
29
30 2003, and see Parkinson, Fischer, & Manstead, 2005, for a review).
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36 Group-based appraisal explains how members arrive at convergent emotional
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38 orientations when they all separately identify with the same group. However, the emotional
39
40 effect depends on each individual's personal identification and appraisal processes rather than
41
42 any influence of other group members' emotions. How identity concerns might affect intragroup
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44 responses to expressed emotions is better explained by social-appraisal processes operating
45
46 between group members, as discussed next.
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50 **Group-based social appraisal.** Group-based appraisal involves assessing the relevance
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52 of events for a salient social identity. Group-based *social* appraisal involves taking other ingroup
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54 members' emotional orientations into account when assessing the relevance of events for a
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3 shared social identity. The idea is that knowing how your group appraises what is happening
4 provides guidance about how you should appraise things too. In other words, the effect does not
5
6 only depend on private detection of group-relevance but also draws on information about other
7
8 ingroup members' emotions. Ingroup members need not be physically present to provide this
9
10 information. For example, studies of indirect intergroup contact show that simply being told that
11
12 a representative of the ingroup has outgroup friends can increase participants' positive attitudes
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14 towards the outgroup (e.g., Wright, Aron, McLaughlin-Volpe, & Ropp, 1997).
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19 Most cases of group-based social appraisal involve less remote contact with one or more
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21 ingroup members. For example, group-relevant appraisals of outgroup members may also be
22
23 registered by observing a representative of the ingroup during an interpersonal interaction. In
24
25 studies of this kind of vicarious intergroup contact, participants may be able to pick up more
26
27 differentiated information about the ingroup's orientation to the object of emotion (van der
28
29 Schalk, Kuppens, Bruder, & Manstead, 2015). For example, Mazziotta, Mumendey, and Wright
30
31 (2011) found that German students who watched videos of another German student having a
32
33 friendly conversation with a Chinese student subsequently felt warmer towards Chinese people
34
35 (see also Ioannou, Al-Ramiah, & Hewstone, 2017). A control condition in which participants
36
37 observed the Chinese student behaving in similar ways without intergroup contact failed to
38
39 produce a comparable effect, effectively ruling out any explanation in terms of increased
40
41 knowledge of the outgroup. Instead, the effect was mediated both by participants' increased
42
43 feelings of self-efficacy about intergroup interaction and by reduced perceptions of intergroup
44
45 uncertainty. Mazziotta and colleagues concluded that observing another group member
46
47 successfully dealing with a potentially difficult social situation showed participants that they
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49 might be able to do the same thing themselves. Such an explanation is clearly compatible with
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3 social-appraisal theory: the observed ingroup member's lack of anxiety and apparent confidence
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5 may have led participants to appraise their own coping potential more positively (see Table 1,
6
7 above) and consequentially changed their emotional response to anticipated intergroup contact.
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10 Just as a toddler finds out that a visual cliff is safe by observing their caregiver's happy
11
12 demeanour (Sorce et al., 1985), participants in Mazziotta and colleagues' study apparently
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14 inferred that Chinese people presented less of an interactional challenge after watching someone
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16 from their ingroup having a relaxed conversation with a member of that outgroup.
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20 More generally, effects of indirect intergroup contact suggest that information about an
21
22 ingroup member's emotions can affect appraisals of objects and events. Indeed, the fact that
23
24 another person shares your social identity usually makes it more likely that your appraisals will
25
26 become aligned with theirs. This kind of convergent effect may be even stronger after observing
27
28 an ingroup member with relatively high status or power within the group (e.g., Delvaux et al.,
29
30 2015; Sy et al., 2005), or multiple ingroup members who all show similar emotional orientations.
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33 **Appraisal norms.** As noted above, other people's emotions can provide information
34
35 both about the nature and practical significance of the appraised object and about the social
36
37 appropriateness of adopting a particular orientation to that object. In group-based social
38
39 appraisal, the normative implications of other ingroup members' emotions are particularly
40
41 important because people are motivated to be part of their ingroup and to gain the approval of
42
43 other ingroup members. In other words, the emotions of ingroup members exert a form of
44
45 "referent informational influence" (Turner, 1991). They show us how the group is inclined to
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47 appraise events and we align with this ingroup appraisal because group membership is a valued
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49 part of our identity.
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3 Referent informational influence is best illustrated by studies of group polarization, in
4 which attitudes and opinions become more extreme following discussion with like-minded
5 people (e.g., Moscovici & Zavalloni, 1969). Other ingroup members' expressed views provide
6 evidence about the group's consensual position on an issue (e.g., Mackie & Cooper, 1984).
7
8 Because members want their group to hold a position that is positively distinctive from rival
9 groups (Brewer, 1991), the position they align with may be one that is more extreme than the
10 apparent consensus (Turner, Wetherell, & Hogg, 1989). Because other group members are also
11 aligning to a positively distinctive position, the extremity of the collective view may further
12 increase.
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24 The well-documented polarizing effects of group interaction on attitudes seem to be
25 paralleled by convergent effects on appraisals of group-relevant issues and associated emotions.
26 For example, Kuppens, Yzerbyt, Dandache, Fischer, and van der Schalk (2013) presented
27 Belgian participants with a concocted news article reporting that the sister of the late Belgian
28 singer-songwriter Jacques Brel had decided to bequeath his belongings to a museum located in
29 France rather than Belgium. Participants who collectively discussed this issue subsequently
30 reported higher levels of indignation than those who discussed differences between traditional
31 and contemporary French chanson. Further, between-condition differences in indignation
32 depended on the opinions that participants reported expressing during the discussion, thus
33 suggesting that appraisal-related factors mediated the intragroup effects. Participants who made
34 negative comments referring to national concerns tended to report greater indignation. In a
35 related study by Yzerbyt, Kuppens, and Mathieu (2016), self-reported fairness appraisals
36 mediated the emotional effects of discussion. In other words, other ingroup members' expressed
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3 emotions apparently provided information about the normative appraisal of a group-relevant
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5 issue, to which participants were motivated to conform.
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8 Delvaux and colleagues (2015) assessed the effects of group interaction on participants'
9
10 emotions across a more extended time scale, allowing a more direct assessment of the unfolding
11
12 process of convergence. Their study focused on student work teams preparing an assessed
13
14 assignment over the course of a University semester. Participants completed on-line
15
16 questionnaires on four separate occasions marked by key points in the progress of their joint
17
18 projects. Measures included self-reports of anger and gratitude towards other group members
19
20 and ratings of perceived norms for expressing each of these emotions while working with other
21
22 group members.
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26 Team members' levels of anger and gratitude converged to produce greater intragroup
27
28 emotional similarity as the project reached completion. Further, the anger and gratitude
29
30 experienced by the group as a whole at each time point predicted group members' individual
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32 levels of each of these emotions at the subsequent time point (even after controlling for the
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34 previous individual-level score), suggesting that participants were influenced by their earlier
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36 sense of how the group generally felt about what was happening.
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40 There was also more direct evidence that emotion norms contributed to their reported
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42 effects. Beliefs that anger and gratitude were desirable and appropriate predicted reported levels
43
44 of these emotions at the following time-point, suggesting that participants were motivated to
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46 bring their appraisals into line with perceived norms. These norms were predicted in turn by the
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48 emotions reported by group members at the previous time-point, suggesting that participants
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50 learnt which appraisals were appropriate by observing other group members' emotions.
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3 At least some of the influence of emotion norms on intragroup emotions may depend on
4 explicit emotion-regulation processes (Porat, Halperin, Mannheim, & Tamir, 2015). Group
5 members may actively attempt to change their emotions so that they better match what the group
6 finds appropriate. In the case of group-based emotions, a possible up-regulation strategy is to
7 work up our level of identification with the group so that group-relevant objects and events are
8 more motivationally relevant for us (Goldenberg et al., 2016). For example, we may actively
9 attempt to focus on what we value about our ingroup or think about how much we like its
10 members. This in turn can enhance our group-based appraisal of the motivational relevance of
11 events that relate to group concerns, thus providing an alternative to the more direct reappraisal
12 strategies that are common in dyadic or individual settings (e.g., Gross & John, 2003). However,
13 if we already identify strongly with our group, alignment with its norms is likely to occur as a
14 result of a more spontaneous social-appraisal process.
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30 **Intragroup Orientational Calibration**

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32 The group-based social appraisal effects discussed in the previous section depend on
33 other group members' emotions providing identity-relevant information about objects and
34 events. However, the emotional orientations of other group members can also help to direct
35 attention and movements more directly. Members' relations with group-relevant events may
36 reciprocally align with one another as a result of adjusting to the changing pushes and pulls of
37 unfolding group behaviour. For example, processes of interpersonal entrainment (e.g., McGrath
38 & Kelly, 1986, and see above) may spread beyond dyads to get the wider group into sync. Local
39 adjustments of the pace and temporal patterning of practical and communicative activities may
40 become more widely distributed as near neighbours mutually influence one another in
41 succession, potentially creating emotional resonance (Durkheim, 1912). The dynamic structure
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3 of a group's emotional actions may therefore consolidate from lower-level orientational
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5 calibration processes.
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8 When group members mutually entrain their orientations during the execution of a shared
9
10 task their emotions are also likely to converge. For instance, each member of a tug-of-war team
11
12 needs to coordinate their allocation of physical energy with those of the others who are pulling
13
14 on the same rope. The reciprocated micro-adjustments of their growing exertions come together
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16 in a joint effort that culminates in a release of tension when a backward or forward fall brings
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18 direct embodied effects on shared experience.
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22 Orientational calibration is often facilitated by structured activities that impose a rhythm
23
24 and tempo on group members' activities (zeitgebers). Repeated patterns of movement provide a
25
26 common focus and make it easier for people to join in with whatever others are doing. A clear
27
28 and simple example is provided by the "muscular bonding" achieved by military personnel
29
30 marching in time and in a common direction (McNeill, 1995, p. 2). Other communal activities
31
32 with more complicated dynamic characteristics also encourage temporal coordination of physical
33
34 activity (e.g., Henriques, 2010), thus reinforcing the sense of being and working together (the
35
36 "corporeal experience of solidarity," Collins, 2004, p. 48). Co-actors who are in sync may
37
38 register the fact that the temporal structure of other group members' actions matches the internal
39
40 proprioceptive signals from their own movements thereby producing a socially extended sense of
41
42 self (e.g., Hove & Risen, 2009; Paladino, Mazzurega, Pavani, & Schubert, 2010; E. Smith,
43
44 2008). In other words, they have an embodied sense that what they are doing personally is
45
46 directly interlocked with what the whole group is doing. The resulting loss of boundaries
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48 between self and others may in turn facilitate intragroup transfer of emotion (Smith, 2008).
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3 A number of studies have shown that getting people to do things in synchrony with one
4 another increases cooperation, solidarity, and mutual liking (e.g., Anshel & Kipper, 1988;
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A number of studies have shown that getting people to do things in synchrony with one another increases cooperation, solidarity, and mutual liking (e.g., Anshel & Kipper, 1988; Wiltermuth & Heath, 2009; see Rennung & Göritz, 2016, for a meta-analytic review). For example, Reddish, Fischer, and Bulbulia (2013) asked small groups of participants to perform repeated actions such as moving their legs and arms up and down in time to a metronome beat played over headphones. For some groups, the rhythm was synchronized across participants thus producing simultaneous movements. For other groups, each participant moved to a different beat. Participants in the synchronous condition perceived their group as more unified and shared more money with other members in a subsequent cooperation task. These effects were stronger still when participants were explicitly instructed to get into sync with each other. In other words, deliberately trying to act together induces unity more powerfully than simply finding out that your actions are coordinated with those of other people. Reddish and colleagues concluded that part of the solidarity-inducing effect of moving together depends on a sense of shared intentionality (e.g., Tomasello & Carpenter, 2007). When people's movements become coordinated, the group becomes an entity that actively affords participation thus adding a sense of flow to collective action (Csikszentmihályi, 1990; Páez et al, 2015). Mutually registered shared intentionality may also be a precondition for the shared sense of efficacy that arises when the group works together on a practical task (see below).

Can reciprocal temporal coordination explain intragroup emotion convergence too? The evidence presented above suggests that people moving together in time tend to like each other more and sense the group's shared engagement in an activity (Rennung & Göritz, 2016). Moving together in synchrony increases the feeling that the group is a coherent entity heading in a particular trajectory. These processes can certainly set the stage for intragroup emotion

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3 convergence when members commonly orient to emotionally relevant objects or engage in
4 collectively meaningful activities, but are not always sufficient to produce genuinely emotional
5 effects on their own. In the next section, I suggest that orientational calibration often combines
6 with social appraisal and identity-related processes to yield deeper effects on collective emotion.
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12 **Section Conclusions**

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15 In this section, I have argued that evidence consistent with the operation of intragroup
16 emotion contagion can be explained instead by reference to either social appraisal or
17 orientational calibration. Group-based social appraisal differs from dyadic social appraisal
18 because of the greater pressures to conformity and ingroup distinctiveness exerted by multiple
19 ingroup members, and because group members can regulate their emotions in response to these
20 pressures by working on their self-categorization and social identification in addition to directly
21 regulating their appraisals. However, not all aspects or cases of intragroup emotion convergence
22 depend on social appraisal. Group members may also arrive at mutually entrained patterns of
23 matching emotional activity and shared states of event-focused attention as a result of
24 orientational calibration. The embodied sense of acting together can also produce a corporeal
25 sense of solidarity and blur the boundaries between group members thus making it easier for
26 other kinds of emotion to spread too.
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42 **Collective Practices**

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45 Intragroup orientational calibration cannot operate in a social vacuum. Even if
46 individuals somehow came together randomly, their behaviours would encourage certain
47 interpersonal responses and constrain others leading to an emergent social structure. Collective
48 practices would consolidate over time even if they were not in place already. In this section, I
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2
3 consider how group rituals, shared meanings and unified social identities facilitate convergent
4 effects of group-based social appraisal and intragroup orientational calibration.
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7 8 **Interaction Rituals** 9

10 Groups that endure over sufficiently extended periods of time often develop their own
11 emotional climates (e.g., de Rivera, 2014), which partly depend on conventionalized practices
12 that serve to coordinate the emotional orientations of their members (e.g., by providing a
13 common focus of attention and by orchestrating synchronized patterns of movement, Knottnerus,
14 2014). Collins (2014) argues that these “interaction rituals” often specifically serve the function
15 of helping people to share emotions (see also Durkheim, 1912).
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24 Songs and dances provide instructive illustrations of interaction rituals because the
25 rhythmic muscular movements involved also carry collective symbolic significance. Thus, the
26 solidarity-inducing effects of entrained activity are reinforced by a shared focus on emotionally
27 meaningful objects. For example, Heider and Warner (2010) investigated devotional four-part
28 harmony singing following the “Sacred Harp” tradition in the southern United States, which they
29 argue produces a new sense of community for otherwise disparate individuals. Singing sessions
30 create a collective experience by virtue of mutual embodied intragroup influence, carried by
31 members’ joint attention to the sounds they are producing and the sacred symbolic text those
32 sounds animate. Trebles, altos, tenors and basses face each other on separate crowded benches
33 arranged in a “hollow square”, their voices reverberating in time with the rhythm. Heider and
34 Warner report that participants experience intense emotions during their singing sessions, often
35 turning to face their neighbours while delivering particularly relished lyrical phrases.
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51 Performances usually conclude with hugging and a sense of mutual good will, suggesting that
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3 this interaction ritual yields convergent emotional orientations both to fellow group members and
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5 the songs they sing together.
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8 As well as creating communal religious fervour, coordinated singing of emotionally
9
10 meaningful verses can also channel common identification with a country or its representatives.
11
12 Slater, Haslam, and Steffens (2018) assessed effects of the collective expression of “passion”
13
14 during pre-match ceremonies in the 2016 UEFA Euros soccer tournament. Before each game,
15
16 players in each team stood in a row, often with arms around each other’s shoulders, and sang
17
18 along while their national anthem was played on the PA system. Slater and colleagues argued
19
20 that the team’s expressed passion in these contexts reflects their solidarity and commitment to
21
22 shared aims associated with their country’s fate in the tournament. It also communicates this
23
24 common sense of purpose to other team members, the fans in the stadium, and the opposing team
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26 who may be intimidated by any apparent show of strength. Thus, more passionate singing
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28 should be associated with better outcomes in the match that follows.
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33 In the study, independent coders of the broadcast TV footage rated the extent of each
34
35 team’s passion based on their vocal volume, facial expressions indicating focus, and physical
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37 closeness between players while the anthem was playing. Higher passion scores were associated
38
39 with conceding fewer goals in the subsequent game, and with winning games during the
40
41 knockout phase of the tournament. These findings are consistent with the proposal that team
42
43 members get in tune with each other’s emotional commitment and sense of determination during
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45 collective singing rituals. The level of passion they can create by standing and vocalising
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47 together helps to align their emotional orientations and convey their unity to those watching and
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49 listening.
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3 Because Slater and colleagues (2018) were unable to collect data from players prior to
4 their collective singing, the apparent effects of shared passion may in fact have depended on pre-
5 existing differences in teams' solidarity or collective efficacy. However, Páez and colleagues
6 (2015) used a longitudinal design to demonstrate that marching and singing during the
7 *Tamborrada* (communal drum march) in the Spanish city of San Sebastian, Spain led to an
8 increased sense of being at one with the group (identity fusion, Swann et al., 2011, and see
9 below). In a subsequent study from the same article, these authors also provided experimental
10 evidence suggesting that participation in a staged interaction ritual produced higher levels of
11 empowerment (as indexed by self-report items from a measure of collective self-esteem,
12 Luhtanen & Crocker, 1992).
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26 Interaction rituals such as group singing may be explicitly orchestrated by individuals or
27 subgroups to induce convergent emotions in a more inclusive collective, thus providing an
28 example of intra-group emotion regulation (see Goldenberg, Halperin, van Zomeren, & Gross,
29 2016; Mackie & Smith, 2018). For example, Granström (2011) analyzed fans' chants during
30 Swedish ice hockey matches. Some of these chants explicitly induced solidarity between
31 supporters by emphasizing common identity or the team's positive qualities. The team was
32 described as "the best" or its name was repeated, often preceded by "Come on!" Designated
33 cheerleaders often initiated this kind of chant at specific times when there were aggressive or
34 hostile murmurings in other pockets of the crowd, or when fans were becoming disheartened
35 after a setback in the game. Their apparent purpose was to shift the emotional register of the
36 group. Certain group members can thus take on the specific responsibility of setting the tone for
37 convergent collective emotions and their regulatory efforts exploit the solidarity-inducing effects
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3 of synchronous activity (e.g., Wiltermuth, 2012) as well as communicating normative
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5 information..
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8 The effects of interaction rituals on intragroup emotion convergence seem to depend on
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10 orientation calibration combined with group-based social appraisal. Participants register their
11
12 entrained common orientation towards collectively meaningful symbols and practices and
13
14 calibrate their movements and appraisals accordingly. Mutual appreciation of the emotional
15
16 significance of their shared activities may further enhance sensitivity to each other's movements
17
18 thus increasing behavioural synchronization and leading to escalation of downstream emotional
19
20 consequences.
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23 24 **Shared Identity** 25

26 Other people's emotions provide information not only about how the ingroup appraises
27
28 identity-relevant events, but also about their common alignment to the same identity concerns.
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30 For example, we may become more confident about someone else's political allegiance when we
31
32 see their emotional reaction to public pronouncements by spokespeople from rival parties.
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34 Along these lines, Livingstone and colleagues (2016) manipulated information about the
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36 emotions expressed by other students in response to a supposed proposal to toughen the marking
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38 of university exams and assignments that was ostensibly intended to combat grade inflation.
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40 Angrier participants were more likely to see themselves as sharing a common social identity with
41
42 other participants who appeared to be similarly angry about this proposal. They were also more
43
44 inclined to select participants with similar levels of anger as work-mates for a subsequent task.
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46 These effects of "emotional fit" (Livingstone et al., 2011) were not simply a result of similarity
47
48 in attitudes because other participants who were presented as equally disapproving but not angry
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50 were nominated relatively less often. Thus, observed emotions can provide social information
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3 that helps people to define group boundaries (Oakes, 1987), and to recognize that other people
4 share the same social identity. This in turn may facilitate further calibration of emotional
5 orientations in a positive feedback loop. A convergent emotional orientation indicates common
6 identity, and that common identity leads group members to align with each other's emotional
7 orientation.
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15 Like most social-appraisal researchers, Livingstone and colleagues presented explicit
16 information about other people's emotions to participants, thus encouraging an inferential
17 process whereby participants drew conclusions about social identity. When people occupy a
18 shared space and are mutually engaged with the same temporally articulated events, the
19 perception of their emotional orientations converging dynamically with our own may produce
20 deeper and more involving states of mutual alignment (Páez et al., 2015). For example, Neville
21 and Reicher (2011) interviewed supporters of Dundee United soccer club, who reported that they
22 derived a sense of belonging, acceptance and validation from watching football matches
23 together. In related research, Novelli, Drury, Reicher, and Stott (2013) found that shared group
24 identification increased tolerance for overcrowding at a well-attended music festival and thereby
25 enhanced emotional well-being. Getting close to people who accept you and whose outlook
26 matches your own during interaction rituals can clearly be a pleasant experience. This positive
27 sense of sharing identity may partly depend on emergent emotional convergence. Hearing the
28 roar of the crowd as a member of your team closes in on goal makes the common purpose
29 manifest to all the fans who are watching and increases the prospect of sharing emotions too. In
30 other words, the effects of other group-members' convergent emotions on shared identity may
31 further reinforce emotional convergence.
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Registering Collective Efficacy

Shared identity can bring additional effects when group members are working together on a practical task rather than simply spectating. Groups whose members are commonly oriented to the same goal and effectively coordinate their actions are usually capable of achieving more than any individual operating in isolation (see Stroebe & Diehl, 1994, for possible exceptions in brainstorming contexts). Registering the unfolding effects of collective effort can consequently produce more powerful emotional outcomes. Indeed, the larger the group, the greater its potential for achieving wide-ranging and impactful results with knock-on consequences for the intensity of emotional engagement. For example, 6,000 UK-based anti-traffic protestors overcame police resistance in 1996 to occupy part of an elevated section of the M41 motorway, where they held a party and drilled holes in the asphalt to plant trees. One participant described the celebration in the following terms: “If you’re left completely free to do whatever you want, it doesn’t feel as wa-hey! exciting as, as the whole crowd pulling together against some opposition and then achieving what it wants, cos you all feel like this sense of unity, and purpose” (Drury et al., 2005, p. 316). Although this collective excitement partly depended on the successful outcomes of the group’s action, Drury and colleagues specifically emphasized the role of the positive sense of empowerment that can arise when large groups engage in shared activities. Registering the task-oriented mastery-related emotions (including excitement and hope) of multiple ingroup members was probably one of the factors contributing to this extended feeling of mutual strength. In other words, a sense of collective efficacy may emerge from reciprocated emotional expressions that indicate high levels of coping potential (see Table 1) as well as from the more practical outcomes that the group achieves.

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3 Consistent with such an account, Hopkins and colleagues (2015) investigated the
4 experiences of religious pilgrims attending an annual month-long Hindu festival (the Magh
5 Mela) in Allahabad, India. Some of the most devoted attendees (known as kalpwasis) stayed for
6 the entire period keeping to a rigorous spice-free vegetarian diet and engaging in regular rituals
7 and prayers. Adherence to these restrictive devotional practices was facilitated by close contact
8 with other kalpwasis who prevented distraction and set appropriate examples for each other.
9 Perhaps surprisingly, kalpwasis described their experience of the Mela as one of sublime bliss
10 (ananda), explicitly rating themselves as more happy and fulfilled than they had ever felt before.
11 Based on regression analyses, the investigators concluded that increases in feelings of being
12 supported by other group members and collective empowerment both contributed to the shared
13 state of ecstasy.
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29 **Intense Embodied Experiences**

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31 Another possible reason why kalpwasis experienced convergent ecstasy in Hopkins and
32 colleagues' (2015) study relates (somewhat paradoxically) to the extent of their self-imposed
33 deprivations. Swann, Jetten, Gómez, Whitehouse, and Bastian (2012) argue that intense physical
34 states of extreme arousal, excitement or suffering intensify the sense of unified agency and
35 animated solidarity induced by collective practices. For example, some initiation rites involve
36 psychoactive drugs, serious danger, or physical damage to the body (Whitehouse, 1996).
37 Konvalinka and colleagues (2011) investigated a fire-walking ritual taking place at summer
38 solstice in a small Spanish village. During this interaction ritual, participants first dance around
39 the dying flames as loud music plays and the crowd cheers them on. A trumpet then signals each
40 person's turn to walk barefoot across glowing embers that can reach a surface temperature of 677
41 degrees Celsius.
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3 For Konvalinka and colleagues' study, both fire-walkers and spectators wore
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5 compression belts that monitored their pulse throughout the ritual. Spectators' heart rates were
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7 relatively slower but showed similar dynamic patterns of change to those of the fire-walkers
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9 themselves, consistent with a process of affective synchronization or dynamic entrainment (see
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11 also Xygalatas, Konvalinka, Bulbulia, & Roepstorff, 2011). Evidence from a related study also
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13 suggested that increases in physiological arousal experienced during a similar ritual were
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15 accompanied by high levels of self-reported happiness when the fire-walking finished (R.
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17 Fischer et al., 2014). Apparently, then, fire-walkers can serve as conduits for a form of
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19 collective emotional heat.
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24 According to Swann and colleagues (2012), participation in this kind of intensive
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26 collective practice not only produces stronger cognitive identification with the group but also
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28 leads to a more visceral fusion of identity where personal agency is experienced as expressing
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30 the collective will of the group. If so, identity fusion may also transform the experience of
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32 group-based emotions so that individual selves channel the affect and energy of the group
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34 members around them. Exactly how the identity fusion construct relates to shared identity and
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36 collective empowerment and differs from the blurring of self-other boundaries induced by
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38 simultaneous sensory experience (e.g., Paladino et al., 2010) requires further investigation, but it
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40 seems clear that the collective emotional consequences of mutually entrained participation in
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42 shared activities can intensify when those activities are arousing or otherwise out of the ordinary.
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47 **Section Conclusions**

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49 Collective emotions often depend initially on dynamic mutual entrainment of movements
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51 and behaviours shaped by group practices with temporal, practical or symbolic structure. People
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53 register their common membership of a group by performing temporally articulated activities
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3 together (Smith, 2008). Emotional orientations to these activities calibrate thus increasing the
4 sense of group unity and purpose, which in turn facilitates further emotional calibration (e.g.,
5 Páez et al., 2015). Working together on practical tasks increases the capacity to achieve change
6 and group members apprehend their collective efficacy with additional emotional consequences
7 (e.g., Drury et al., 2005). When group activities also produce intense embodied effects, this too
8 can escalate emotional responsivity (e.g., Konvalinka et al., 2011).
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10
11 To the extent that group members arrive at matching patterns of expression and action as
12 a consequence of these processes, they have no need to rely on mimicry-based interoceptive
13 feedback to register their emotional engagement with unfolding events. Instead, their common
14 orientation is evident in the mutually attuned object-directed stances of the people around them
15 with whom they directly share agency. Registration of the group's synchronized object-directed
16 evaluative activities provides a sense of collectively shared emotion. Other ingroup members'
17 emotional responses may also activate group-based social-appraisal processes by providing
18 information not only about the emotional significance of what the group is doing (e.g., Slater et
19 al., 2018) but also about shared allegiance to a common cause (e.g., Livingstone et al., 2011). In
20 collective co-present settings, both kinds of social appraisal usually run in parallel with
21 orientational calibration with each process reinforcing the emotionally convergent effects of the
22 other.
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44 **General Conclusions**

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46 In this paper, I have distinguished three processes that potentially account for emotion
47 convergence in interpersonal and intragroup settings. I argued that forms of emotion contagion
48 based on mimicry have little empirical or theoretical support, but that both social appraisal and
49 orientational calibration provide viable explanations of the transfer of object-directed emotion
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3 from one person to others. These two relation-alignment processes often work together and
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5 bolster each other's social effects.
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8 Does intragroup emotion convergence arise in the same ways as interpersonal emotion
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10 convergence? Increasing numbers of reciprocally interacting individuals certainly bring the
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12 potential for stronger effects, but is the quality as well as quantity of social influence different?
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14 This paper has proposed that the nature and extent of both social-appraisal and orientational-
15
16 calibration processes are transformed in intragroup contexts for a number of reasons.
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20 First, people attend to the orientations of ingroup members relatively more because they
21
22 not only provide more trustworthy information about practical aspects of what is happening but
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24 also indicate the group's normative stance. Second, group members' desire to belong to a
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26 positively distinctive group (e.g., Brewer, 1991) often encourages them to align with a position
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28 that is more extreme than the perceived group norm (e.g., Turner, Wetherell, & Hogg, 1989),
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30 potentially producing escalating effects on appraisals and emotions when multiple group
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32 members register and respond to one another's apparent orientations. Third, group norms may
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34 lead members to regulate their emotions so that they better match those favored by other group
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36 members. In group rather than dyadic contexts, an additional strategy for achieving this
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38 regulatory goal involves working up your level of ingroup identification to produce an indirect
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40 reappraisal effect (Goldenberg et al., 2016). For example, actively reminding yourself about a
41
42 group's personal significance to you can boost the motivational relevance of events relating to
43
44 group concerns and consequently produce stronger group-related emotions. At a less strategic
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46 level, increased attention to other ingroup members' orientations also makes people more
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48 susceptible to the effects of gaze-cuing and behavioral entrainment, which both contribute to
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3 intragroup orientational calibration. Because these processes operate reciprocally between
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5 multiple group members, the potential for emotional resonance correspondingly increases.
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8 Another difference between intragroup and dyadic contexts is that groups are often
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10 engaged in consequential activities that have a shared emotional meaning for their members.
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12 Those activities attain a coordinated temporal structure as a result of reciprocal entrainment,
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14 which is further sustained by the zeitgebers provided by the temporally articulated unfolding
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16 situation to which group members are commonly orienting. More strategic emotion-regulatory
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18 processes may contribute to these entrainment processes too. For example, people who are
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20 instructed to get into sync with each other's temporally structured movements (e.g., Reddish et
21
22 al., 2013) need to provide overt cues that can help those other group members people pick up the
23
24 rhythm. It seems likely that they also make an effort to display their dynamic emotional
25
26 orientations to those around them for similar reasons. More generally, group members are often
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28 motivated to bring other members' emotions into line with those of the group as well as to align
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30 their own emotions with perceived group norms (e.g., Delvaux et al., 2015; Porat et al., 2015).
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35 Evidently, no single explanatory mechanism applies to all possible aspects of intragroup
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37 emotion convergence. Processes of strategic group-directed emotion regulation, implicit and
38
39 inferential group-based social appraisal, and intragroup orientational calibration all seem to
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41 contribute to the reported effects. Each of these processes involves alignment of group
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43 members' orientations to the collectively meaningful events to which the group is exposed or in
44
45 which it participates more directly. However, their responsiveness to different factors allows
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47 researchers to determine their relative contribution to collective emotions. For example, the
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49 operation of group-based social appraisal depends on emotion attribution, self-categorization and
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51 social identification, but orientational calibration need not involve any explicit registration of
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3 group- or emotion-related information. Orientational calibration is specifically distinguishable
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5 by its close dependence on temporal coordination of movements and attunement to social
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7 signals. Finally, regulatory processes are activated by identification of a regulatory concern and
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9 terminated by the removal of that concern and are therefore identifiable on the basis of their
10
11 persistence when thwarted (e.g., Maitner, Mackie, & Smith, 2006). Future research should
12
13 attend to these potential mediators and moderators of intragroup convergence effects in order to
14
15 clarify which combinations of processes are operating in different contexts.
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19 This paper has focused mainly on intragroup processes and said relatively less about how
20
21 convergent intragroup orientations to emotional events are affected by intergroup relations (see
22
23 Mackie & Smith, 2018). It is important to acknowledge that group members who align with a
24
25 shared identity are often also aligning themselves in opposition to the identity of a competing or
26
27 antagonistic outgroup (Iyer & Leach, 2008). A fuller understanding of intragroup emotion
28
29 convergence awaits further consideration of how these intergroup dynamics might impact on the
30
31 relation-aligning processes distinguished above.
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35 A final issue that requires further research attention is the role of physical co-presence in
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37 intragroup emotion convergence processes (e.g., Parkinson & Lea, 2011). Shteynberg and
38
39 colleagues' (2014) showed that the mere perception that other ingroup members are attending
40
41 remotely to emotional objects can intensify affective responses (arguably because it activates
42
43 social appraisals of motivational relevance) raising the possibility that mass communication may
44
45 escalate emotional convergence (Shteynberg, 2015). However, the analyses of dynamic
46
47 entrainment, shared identity and collective efficacy presented above apply best to situations
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49 where group members are able to interact freely with one another and work together in a shared
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51 space. Does this mean that emotion convergence in on-line communities (e.g., Skowron &
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3 Rank, 2014) depends on a more restricted range of processes based exclusively on inference-
4 based social appraisal and strategic regulation? Does the addition of supplementary channels of
5 information correspondingly increase the possibilities for reciprocal emotional influence, with
6 virtual reality ultimately providing a perfect simulation of genuine social and environmental
7 contact? And do new media generate as yet undiscovered possibilities for coordinating
8 emotional orientations in cyberspace (Parkinson, 2008)? The approach developed in this paper is
9 intended to provide theoretical tools that are capable of addressing these and other questions
10 about how emotions operate in both real and virtual group contexts.
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22 The central conclusion of this paper is that intragroup emotional convergence cannot be
23 fully explained by reference to cognitive or interoceptive processes operating separately in the
24 heads of individual group members. Although processes of personal appraisal and self-
25 categorization clearly contribute to many documented effects of finding out about other people's
26 emotional orientations, dynamic and reciprocal engagement with other group members and direct
27 embodied participation in group activities are necessary conditions for the emergence of
28 genuinely collective emotions. Single-minded approaches to socially distributed and co-
29 constructed affective phenomena risk missing their substance, providing explanations of internal
30 representations of what is happening rather than group-based emotional life itself.
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Table 1:**Examples of Appraisal Attributions Based on Perceived Object-Directed Emotions**

| | <i>Perceived object-directed emotion</i> | <i>Attributed appraisal</i> |
|--|--|-----------------------------|
| <i>Interpersonal effects on primary appraisals</i> | Emotional orientation to object | Motivational relevance |
| | Pleasure about object | Motivational congruence |
| | Displeasure about object | Motivational incongruence |
| <i>Interpersonal effects on secondary appraisals</i> | Hope, confidence about task | High coping potential |
| | Fear, anxiety about outcomes | Uncertain coping potential |
| | Anger, contempt, gratitude | Other-accountability |
| | Guilt, shame, embarrassment, pride | Self-accountability |
| | Sadness, depression | Low future expectancy |

Table 2:**Examples of Orientational Calibration Effects**

| <i>Person A's object-directed emotion</i> | <i>Effect on Person B</i> | <i>Dynamic reciprocal effects</i> |
|---|----------------------------|--|
| Emotional orientation to object | Cued gaze | Calibrated gaze |
| Positive orientation to object | Approach stance | Shared approach movements |
| Negative orientation to object | Avoidance stance | Shared avoidance movements |
| High-energy orientation to object | Increased action intensity | Shared intensity of movements |
| Calm orientation to object | Reduced action intensity | Shared reduction in intensity of movements |
| Change in orientation | Adjustment | Mutual adjustment |

Table 3:**Alternative Explanations of Interpersonal Emotion Convergence**

| | <i>Active ingredient of influencing emotion</i> | <i>Dependence on interpersonal contact</i> | <i>Automaticity</i> |
|----------------------------------|---|--|----------------------|
| <i>Emotion contagion</i> | Quality of emotional experience (excluding object-directedness) | Contact required | Implicit |
| <i>Social appraisal</i> | Information about object-directed emotion | Contact may be remote or indirect | Implicit or explicit |
| <i>Orientational calibration</i> | Event-attuned dynamic orientation | Direct and continuous contact required | Implicit |

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6 Figure 1: *Primitive emotional contagion according to Hatfield and colleagues' (1994) model*
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10 Figure 2: *Hareli and Hess's (2010) reverse-engineering model of the social appraisal process*
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12 (adapted from Parkinson, 2011, with permission from Blackwell/Wiley).
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17 Figure 3: *Simplified representation of the orientational-calibration process*
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19 Note: shading indicates temporal structure of bodily movements with increasing interpersonal
20 synchronization over time. Real-time effects of specific directional movements and ongoing
21 effects on the practical situation are omitted for reasons of clarity.
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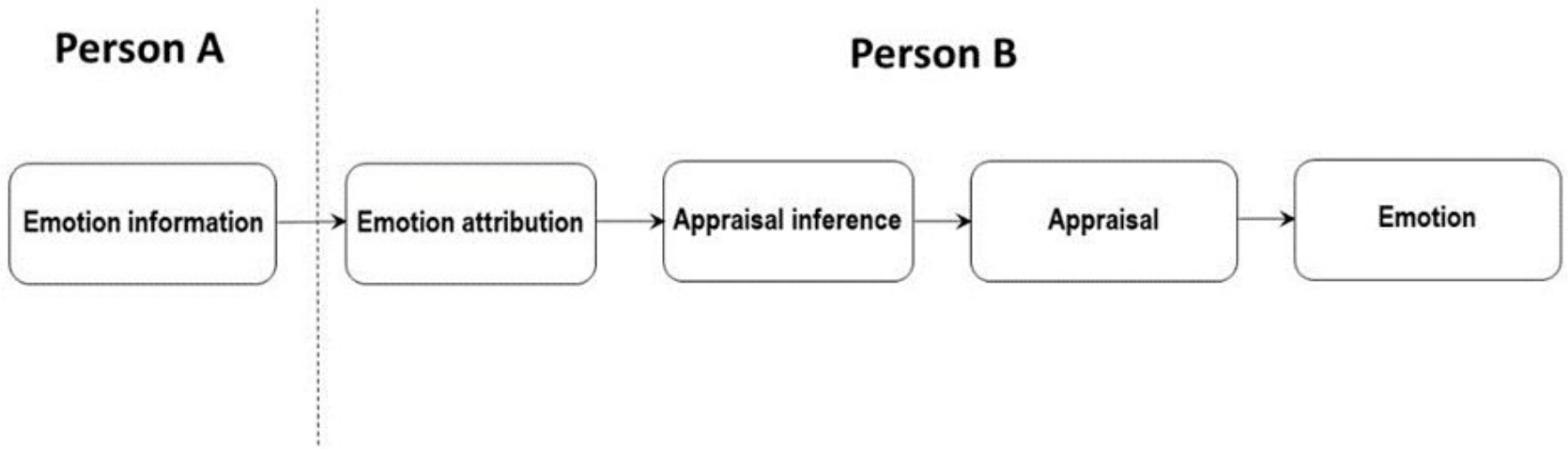
28 Figure 4: *An integrated orientational-calibration and social-appraisal proces.*
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30 Note: Person B's developing emotional orientation may also provide information about emotion
31 and appraisal to Person A as a reciprocal process.
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