Collective emotion: an experimental framework

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Emotional gatherings are ubiquitous in human societies: crowds cheer in stadiums, friends and relatives celebrate or mourn as a group, and online communities thrive on loving or hating together (Turner & Stets, 2005). Despite many differences between these examples, humans exhibit patterns of collective behaviour during these events: individuals chant, applaud in synchrony and rally round to act in a coordinated fashion (Sumpter, 2006). Surprisingly, the study of collective human behaviour has remained largely independent from research on the collective patterns of *emotion* unfolding during these social gatherings. Yet, social interactions cause emotions and emotions shape social interactions (Parkinson, 1996; Keltner & Gross, 1999; van Kleef et al., 2016): humans express and convey emotions, influence each other and experience similar emotions. The label ‘collective emotions’ is often used to refer to those emotions that individuals experience together (Salmela, 2012). Given their central importance in human social interactions, it is crucial that we gain a better understanding of collective emotions, their mechanisms and functions.

Collective emotion has aroused growing interest from researchers in social sciences, psychology, and philosophy (von Scheve & Salmela, 2014). In this multidisciplinary domain, a collective emotion is typically conceived of as a group-level pattern of emotional responses (Goldenberg, 2020), whose function is to foster social cohesion and collective action (Collins, 2014; Salmela, 2014; Salmela & Nagatsu, 2016). However, despite a rich and expanding theoretical literature, there is no consensus on the nature, mechanisms and specific consequences of collective emotion. To date, accounts rely on different conceptualizations of emotion, different levels of description, different methods of investigation and different terminologies (for an overview see Salmela, 2014 and von Scheve & Salmela, 2014). For instance, the terms collective emotion (Gilbert, 2002; von Scheve & Ismer, 2013; Salmela & Nagatsu, 2016; Schmid, 2017), group emotion (Smith et al., 2007; Menges & Kilduff, 2015), shared emotion (Salmela, 2012; Thonhauser, 2018; Szanto & Krueger, 2019), extended emotion (Stephan et al., 2014; Slaby, 2014; Krueger & Szanto, 2016) and affective resonance (Mühlhoff, 2015) have been used to describe similar phenomena occurring at the levels of mother-infant dyads (Krueger, 2014), work teams (Huebner, 2011), organizations (Schmid,

2014), sports audiences (Thonhauser & Wetzels, 2019), online communities (Holyst, 2017; Garcia & Rimé, 2019) and nations (Bar-Tal et al., 2007; Sullivan, 2018). Furthermore, accounts of collective emotion differ in their theorizing, insisting upon different emotional components, such as emotional appraisal or subjective feeling, and putting forwards various explanations in terms of bottom-up factors, top-down factors or both (see Pacherie, 2017 for a review). As a result, collective emotion represents a challenge for contemporary affective sciences. Despite the recent surge in research on collective emotion, experimental evaluation of theoretical claims is critically lacking, which continues to hinder progress in the field.

Thus, this work aims at uniting the current knowledge concerning collective emotion into a common framework in order to foster experimental investigation. Here, we are not talking about collective emotion to imply that social entities can experience emotions in the same way as individuals: rather, we will leave aside the existing discussions on the nature of group agents and the possibility of group consciousness (Pacherie, 2017; List, 2018) and stick to a consensual view of emotion as primarily involving a set of physiological responses, subjective experiences, expressions and action tendencies at an individual-level¹ (Scherer, 1984). Furthermore, we will restrict the current discussion to acute collective emotional responses occurring in the range of seconds to minutes, as opposed to moods. We thus use collective emotion as an umbrella term describing the alignment of individual emotional responses through mutual and reciprocal influences (von Scheve & Ismer, 2013).

In Section 1, we identify three characteristics of collective emotion that are recurrent in the existing literature and emphasize their relation to social and cognitive processes. In Section 2, we build upon these characteristics to provide a typology of collective emotion, ranging from low to high degrees of collectiveness. In Section 3, we review the available empirical evidence regarding

¹ See, for example, Huebner (2011) and Gilbert (2002) for theories of collective emotion that do not necessarily assume similar emotional experiences at an individual-level. These theories formulate accounts in terms of distributed cognition and joint commitment to evaluative judgments, respectively.

candidate mechanisms, factors and outcomes of collective emotion, and we outline potential directions for future research.

1. Main characteristics of collective emotion

Despite theoretical divides, we note three recurrent characteristics of collective emotion in the existing literature: emotion alignment, feeling of connectedness and mutual awareness.

1.1. Emotion alignment

The first characteristic of collective emotion is *alignment*, which refers to the “dynamic and reciprocal adjustment of the components of a system for its coordinated functioning” (Dumas & Fairhurst, 2021, p. 3). Assuming that individuals can be viewed as components of collective systems, emotion alignment is characterized in terms of three main properties: convergence, direct coupling and synchrony. First, *convergence* refers to alignment in form and content: individuals emotionally converge when their emotions become increasingly similar over time (Anderson & Keltner, 2004; Dezechache et al., 2016). Two individuals are said to converge when they appraise (i.e., consciously or unconsciously evaluate) a situation similarly (i.e., convergence in evaluative content) and when they exhibit similar facial expressions, manifest similar action tendencies and experience similar feelings (i.e., convergence in emotional response). Second, *direct coupling* assumes that convergence is non-incident and results from reciprocal entrainment between individuals (i.e., with social interaction), as opposed to merely *indirect coupling* mediated by a common emotion-elicitor (i.e., with attention directed toward the same event). Lastly, *synchrony* refers to the temporal alignment of emotional responses across individuals (Wood et al., 2021), so that the time courses of individual responses predict each other. Note that synchrony may result from indirect coupling, direct coupling or both. Synchrony due to indirect coupling refers to convergent linkage, whereas synchrony due to direct coupling refers to complementary linkage (Elfenbein, 2014) and can be conceptualized as the co-variation of individual emotional responses within an interpersonal system (Butler, 2011). Overall, convergence, direct coupling and synchrony predict several emergent group-level characteristics of

emotional responses during collective emotion (Goldenberg et al., 2020): consolidation and synchronization (i.e., decrease in interpersonal variability), up- and down-regulation (i.e., convergent increase or decrease in amplitude) and emotional cascade (i.e., increase in length). What are the processes underlying emotion alignment? We now discuss different categories of mechanistic explanations for emotion alignment: interaction, identification and institutionalization (see also Menges & Kilduff, 2015; Dezecache et al., 2016).

Interaction refers to the reciprocal influence of individuals during a social interaction. A prominent set of theories accounts for emotion alignment in terms of emotion contagion². According to the Primary Emotion Contagion model (Hatfield et al., 1992), individuals tend to unintentionally and automatically mimic the emotional facial expressions and bodily postures of other individuals, leading them to experience similar emotions through afferent feedback. Moreover, the temporal dynamic between the expresser and the perceiver implies some degree of synchrony and direct coupling between emotional responses. Thus, contagion has been defined as a potential precursor of collective emotion (Hatfield et al., 2014). Another seminal account of emotion alignment argues that it does not result from automatic emotion contagion. Instead, alignment is the by-product of an adaptive perception-action matching system that promotes the implicit representation or simulation of others' actions during social interactions (Preston & de Waal, 2002). Two further mechanisms could also contribute to explaining emotion alignment: social appraisal and orientation calibration (Parkinson, 2019). On the one hand, appraisal theories (Frijda, 1986; Lazarus, 1991a; Scherer et al., 2001) consider that an emotional response results from the appraisal of a situation. Appraisals are permeable to contextual social information, including cues about other individuals and their emotions, hence, one's appraisal of a situation is continuously shaped and revised based on one's own implicit or explicit representation of others' emotional responses (Manstead & Fischer, 2001). This process, called social appraisal, provides an explanation for emotion alignment over time. On the

² Emotion contagion (i.e., a set of mechanistic explanations) is often conflated with emotion alignment. We distinguish both to emphasize the existence of alternative explanations of emotion alignment (e.g., social appraisal, orientation calibration).

other hand, orientation calibration refers to the role of interpersonal entrainment mechanisms: during social interactions, individuals spontaneously adjust their gaze direction and bodily movements to those of other people, orienting their attention and behaviour in socially relevant ways (Parkinson, 2019). Unlike social appraisal, the orientation calibration hypothesis proposes that emotion alignment results from low-level bodily synchronization rather than the perception of others' emotions. Typical empirical measures of interaction effects involve the manipulation and recording of interpersonal synchrony at autonomic (Palumbo et al., 2017), cerebral (Nummenmaa et al., 2018) and motoric (Hove & Risen, 2009) levels (see Section 3.3).

Identification refers to the effect of one's perceived affiliation with another individual or social group (Taipale, 2019). According to the Intergroup Emotion theory (Smith, 1993), individuals who self-categorize as members of a specific social group appraise a situation from this group's stance. Consequently, individuals identifying with the same social group are likely to respond similarly to a group-relevant situation, experiencing similar emotions on behalf of the group: group-based emotions (Mackie & Smith, 2017). According to the Social Identity Theory (Tajfel & Turner, 2004), social identification therefore explains emotional convergence within social groups. These emotional responses to group-relevant events do not necessarily involve emotional synchrony or direct coupling between interacting individuals. When remotely located, unacquainted political supporters learn about the election of their leader, they experience *group-based* joy, but the group members may experience these emotions at different points in time and in complete isolation from one another. Such social identification can be manipulated in experimental settings using, for instance, the minimal group paradigm (Tajfel, 1970).

Institutionalization refers to the influence of emotional norms on emotion alignment. Through socialization, individuals learn the range of appropriate emotions they ought to feel (Hochschild, 1979) and display (Ekman & Friesen, 1969) in a given context. These rules, which are culture-specific, co-exist with ideal affects mirroring individuals' preferences for being in specific affective states (Tsai et al., 2006). When individuals identify with a common social group, they are

likely to adopt the same norms and to endorse the group's ideal affect. Crucially, individuals are motivated to comply with and to conform to the group's norms, even without awareness of the effects of social influence (Cialdini & Goldstein, 2004). Discrepancies between one's actual emotion and the emotional norms or ideals can lead to investing resources in emotion work (Hochschild, 1979) such as emotion regulation (Gross, 1998) and co-regulation³ (Butler & Randall, 2013), which previous research has argued serves as a basis for collective emotion (Krueger, 2015).

To sum up, we distinguish between two main paths to emotion alignment: the interactive path pertaining to perception and representation of other individuals, and the non-interactive path relying on social identification and institutionalization (for a similar distinction, see Klep et al., 2011). However, it is noteworthy that interaction, identification and institutionalization mechanisms interplay as respective factors and moderators (Menges & Kilduff, 2015). For example, self-categorization is dynamic and relies on the saliency of a particular group membership at a given point in time, which can be heavily influenced during social interaction (Stets & Trettevik, 2014; Smith & Mackie, 2015). Conversely, interaction mechanisms such as mimicry-based contagion and perception-action matching are permeable to social identification (Wrobel & Imbir, 2019; Smith & Mackie, 2016b). As an illustration, individuals may socially appraise the emotional expressions of a fellow group member (i.e., group-based social appraisal, see Parkinson, 2019) as cues indicating the relevant emotional norms of that group (Illouz et al., 2014). Consequently, these individuals would engage in specific forms of emotion regulation to conform to these norms, such as interpersonal emotion regulation (Butler & Randall, 2013; Zaki & Williams, 2013) measured as time-lagged physiological covariation between individuals (Helm et al., 2018). Mechanisms pertaining to interaction, identification and institutionalization are the hypothetical bases for emotion alignment during a collective emotion (Pacherie, 2017). However, group-level patterns of emotion alignment

³ Following Butler & Randall (2013), we define emotion co-regulation as direct interpersonal coupling that entails synchronization and convergence of emotional responses towards an optimal level. It is worth noting that co-regulation is a morphostatic process that predicts fluctuations towards a stable emotional state. In contrast, interaction mechanisms such as emotion contagion are morphogenic processes that predict fluctuations towards an altered emotional state (e.g., mutual entrainment resulting in increased emotional arousal).

are not the only characteristics put forth in research on collective emotion. Erudition in social sciences and philosophy stresses that collective emotion is a shared experience that involves a specific kind of feeling and awareness of other individuals, although again, terminologies and definitions vary across research traditions.

1.2. Feeling of connectedness

The second characteristic of collective emotion refers to the experiential quality of collective or shared experiences: compared to non-collective emotional experiences, collective emotion *feels* different. In social sciences, this idea draws from the pioneering work of Durkheim (1915) on rituals. The main function of these collective gatherings is to produce and maintain social cohesion through elicitation of *collective effervescence*. In his neo-Durkheimian account of collective emotion, Collins (2014) describes collective effervescence as “the rhythmic entrainment of all participants into a mood that feels stronger than any of them individually, and carries them along as if under a force from outside” (p. 299). This description highlights a few emergent properties of collective emotion at the experiential level: high emotional arousal and low emotional dominance (Russell & Mehrabian, 1977), as well as the “feeling of belonging and social integration” (Páez et al., 2015, p. 720) or the “feeling of oneness with the group” defining identity fusion (Swann et al., 2012, p. 441). While social rituals are ubiquitous (Collins, 2014; Whitehouse, 2021) and experiences of collective effervescence frequent in everyday settings (Gabriel et al., 2019), one can distinguish between two types of rituals (Whitehouse & Lanman, 2014; Whitehouse, 2021, pp. 55-58): on the one hand, doctrinal rituals that are high-frequency, large-scale, low-arousal and foster group identification by way of routinized behaviours; on the other hand, imagistic rituals that are low-frequency, small-scale, highly arousing and lead to identity fusion by way of intense shared emotional experiences. Levels of arousal and dominance characterizing an emotional experience can be empirically assessed through self-report scales of emotion, such as the Self-Assessment Manikin (SAM; Bradley & Lang, 1994), whereas other self-report tools measure collective effervescence (Gabriel et al., 2019), perception of emotional synchrony (PES; Włodarczyk et al., 2020), and inclusion of other in the self (IOS; Aron et al., 1992).

Accordingly, collective emotion could imply the co-existence of two types of feelings: the feeling elicited as a response to the emotional event (e.g., the group-based joy inspired by the victory of one's political party) and the feeling of connectedness elicited as a response to the sharing of this event (e.g., the feeling of unity resulting from the perception of joy overwhelming all party members).

An alternative account of the experiential quality of collective emotion draws from the phenomenological tradition and the concept of "we" experience inspired by Tuomela's (2007) terminology. The core idea is that a collective emotion is felt as *our* emotion rather than *my* emotion, although it is debated as to what exactly is meant by the first-person plural. On the one hand, "we" emotional experience is thought to result from a phenomenal fusion, whereby individuals pre-reflectively⁴ experience their emotion from a first-person plural perspective (Schmid, 2014). This approach bears strong similarities to the aforementioned description of feeling of connectedness in terms of identity fusion: the specific experiential quality of collective emotion derives from self-categorization as a group member leading to a blurring of the distinction between the self and other individuals. On the other hand, "we" emotional experience is thought to result from identification with other specific individuals (León et al., 2017) – as opposed to self-categorization as a group member – and representation of their emotions, while preserving the distinction between the self and these other individuals (Zahavi, 2015; Zahavi & Rochat, 2015). This latter view on emotional sharing differs from the experience of vicarious feelings (i.e., feeling the emotion of others as one's own) and from empathy (i.e., understanding the emotion of others without necessarily feeling it). Furthermore, this account of emotional sharing insists that collective emotion not only relies on a feeling of connectedness but also on reciprocal or mutual awareness between partaking individuals (see Thonhauser, 2018 for an articulation of these two characteristics).

⁴ In this paper, we distinguish between (i) reflective awareness, which supposes explicitly reflecting upon one's own experience, and (ii) pre-reflective awareness, which does not suppose such explicit reflection.

1.3. *Mutual awareness*

According to Salmela (2012) and Salmela & Nagatsu (2017), individuals involved in a collective emotion are mutually aware of each other and their emotion alignment: (i) individuals are aware that their emotions align, (ii) they know that other individuals are aware of this fact too, and (iii) they know that other individuals know of their awareness of this fact. Alternative accounts contend that collective emotion does not necessarily imply iterative inferences and common knowledge about the emotions of other individuals. Rather, collective emotion entails “mutual awareness of a plurality of partaking individuals” (Thonhauser 2018, p. 1008) or mutual awareness of co-presence (León, 2020). We describe two candidate mechanisms for mutual awareness in the context of collective emotion.

First, mutual awareness during collective emotion suggests that partaking individuals engage in joint attention. In paradigmatic examples of collective emotion, such as the emotion of audience members watching a sports game (Thonhauser & Wetzels, 2019) or listening to music (Krueger, 2014), individuals exhibit shared or joint attention (Shteynberg, 2018; Saposova & Carpenter, 2019). Previous research suggests that mutual attention, a type of social attention, underlies mutual awareness between two individuals that simultaneously attend to the same event, as well as to each other attending to the event and to the other individual. Saposova & Carpenter (2019) define mutual attention as “individuals being aware – in a second-person relation to each other, but without intentional communication – that they are attending to the same thing with each other” (p. 263). Therefore, social attention, especially mutual attention, provides a mechanistic basis for collective emotion (Pacherie, 2017; Krueger, 2014; Collins, 2014).

Second, co-representation of the emotions of other individuals may also foster awareness of the alignment of their emotions with ours. As mentioned before, individuals tend to spontaneously and implicitly represent the behaviours, thoughts and feelings of other individuals in addition to their own (Smith & Mackie, 2016b). This is crucial, for instance, when individuals engage in cooperative joint action, whereby individuals must represent the action plan of their partner as well as their own

in order to successfully coordinate (Sebanz et al., 2003). Two characteristics of co-representation are worth stressing: (i) co-representation can be implicit and does not necessarily imply reflective awareness of other's mental states and (ii) successful co-representation entails, to some extent, distinguishing between the self and other individuals, so that individuals do not mistake others' representations for their own. Therefore, individuals who are representing their own emotion and those of other individuals (i) need not be reflectively aware of these emotions and (ii) need not feel the emotion of the co-represented individual. *Implicit* co-representation is usually measured through social interference effects, such as the Social Simon Effect (Sebanz et al., 2003), which vary according to the affective context (Beaurenaut et al., 2021). However, co-representation can also lead to *explicit* inferences of the mental states of other individuals. When it does, successful co-representation is assessed as inferential accuracy: for instance, empathic accuracy (Ickes, 2009; 2016) measures the ability to infer the thoughts and feelings of another individual, and emotional aperture (Sanchez-Burks & Huy, 2009) measures the ability to infer the emotional composition of a group (see Section 3.4).

Therefore, we can describe mutual awareness during collective emotion as the result of mutual attention that enables successful emotion co-representation. However, when individuals do not engage in mutual attention (e.g., when they do not have perceptual access to each other), they may instead simulate the emotions of others based on the belief that one's experience is shared (Smith & Mackie, 2016b). In such contexts, where information about other individuals is lacking, mutual awareness of emotion alignment during a collective emotion could rely on the combination of social projection and self-stereotyping (Cho & Knowles, 2013): the former refers to attributing mental states that are similar to one's own to other individuals, whereas the latter refers to adopting mental states that are congruent with one's beliefs about the group one identifies with.

In the first section, we reviewed the literature on collective emotion to identify its main characteristics and the corresponding candidate social and cognitive mechanisms. Emotion alignment refers to group-level patterns of emotional responses at the behavioral, experiential, cerebral and

autonomic levels; feeling of connectedness and mutual awareness refer to the experiential quality of collective emotion, which involves changes in the representation of other individuals and the self, either reflectively or not. Summing up, current knowledge predicts several measurable characteristics of collective emotion: first, consolidation, synchronization, amplitude regulation and cascades of emotional responses; second, subjective feelings of rapport and social integration; third, joint attention and co-representation of emotional states that can lead to explicit and mutual knowledge. Although these characteristics are conceptually independent, we highlighted their potential interplay during collective emotion. Nonetheless, temporal and causal relations between these characteristics and the existence of common modulators remain to be investigated experimentally.

2. Typology of collective emotion

As mentioned in the introduction, a striking aspect of the literature concerning collective emotion is the diversity of examples and definitions of this phenomenon. Yet, we argue that collective emotion is a broad construct and that heterogeneity sometimes reflects differences in degrees of collectiveness rather than theoretical incompatibility.

2.1. Salmela's typology

Salmela (2012) argued that the collectiveness of an emotion varies along a continuum and distinguished three types of collective emotion: weakly, moderately and strongly shared emotions. This typology builds on a definition of emotions in terms of concerns (i.e., goals, interests, attachments). Consequently, the collectiveness of an emotion depends on the mode under which individuals share concerns with one another. According to Salmela, the weakest degree of collective emotion corresponds to overlapping concerns with private commitments, such as the fear of private brokers anticipating a stock crash. The brokers share a common overlapping aversion for decreasing stock value, and their attachment to stock value is private, insofar as they care about stock value for

their own personal reasons, independently from other brokers. In comparison, moderately collective emotions correspond to social concerns with private commitment, such as the joy of supporters when their favourite team scores. Here, the supporters' concern is social, insofar as the team's victory benefits the group of supporters as a whole and there is mutual knowledge that supporters care about victory. Nonetheless, commitments remain private, as individuals can revise their commitment (i.e., they can stop supporting the team) unilaterally without affecting others. Lastly, strongly collective emotions correspond to social concerns with collective commitment. Unlike the supporters' joy, the joy of the team members playing the game is strongly collective, in that their commitment to victory is collective, hence, their individually experiencing joy depends on other team members experiencing joy, too. In summary, the more social the concern and the commitment, the more collective the emotion.

Salmela (2012) stressed that modes of sharing concerns prevail in determining the degree of collectiveness of an emotion. This proposal is insightful, because human groups differ in their degree of collectiveness (i.e., overlap of concerns, strength of commitment) to begin with, and because this degree of collectiveness is contextual. However, by Salmela's own admission, this typology only accounts for the "intentional background" (Salmela, 2014, p. 171) of collective emotion, namely the set of beliefs, values and commitments pre-existing to experiencing collective emotion. Therefore, a typology based on shared concerns insists on the specific antecedents of collective emotion, such as group membership, but ignores the emotional dynamics unfolding *during* the collective emotional event. More recently, Thonhauser (2022) distinguished between five types of collective emotion, convincingly insisting on differences in affective experiences but intentionally dismissing a classification in terms of underlying mechanisms. We believe a closer examination of the underlying mechanisms of collective emotion is necessary if we are to provide a relevant framework for empirical research⁵.

⁵ Although our definition of collective emotion is broader than Thonhauser's, our characterizations of the phenomenon show similarities. However, we believe Thonhauser's primary focus on affective experiences is too restrictive. It is now a consensual view that emotions are multi-componential phenomena that extend

2.2. A new typology of collective emotion

To address this gap, we propose a complementary account of emotional collectiveness based on the categories of social and cognitive processes that we identified in Section 1: emotion alignment, mutual awareness and feeling of connectedness. This proposal draws on recent typologies of social attention (Siposova & Carpenter, 2019) and social agency (Silver et al., 2021) based on their dynamic characteristics. Here, the type of collective emotion depends on the categories of social and cognitive processes involved and the extent to which they occur. We define four types of collective emotion: group-based, common, mutual and “we” collective emotions, ranging from low to high degrees of collectiveness. Figure 2 represents this continuous scale, with grading colours indicating that there is no sharp separation between contiguous types of collective emotion. We stress that this scale does not reflect an exhaustive categorization of group emotions, as other group-level patterns can emerge involving divergent emotions within the group (e.g., complementary, antagonistic). Moreover, this scale does not reflect the temporal unfolding of a collective emotion, although lesser degrees of collective emotion are sometimes prerequisites for higher degrees of collective emotion. Lastly, we restrict this typology to non-incidental cases of collective emotion, so that a minimal prerequisite is that individuals attend and respond to the same emotion-eliciting event. In the following paragraphs, we present the four types of collective emotions, indicate their relation to existing theories and provide examples.

beyond the realm of subjective experiences. Thus, exclusively focusing on affective experience comes with the risk of overlooking implicit aspects of emotion that can warrant other relevant distinctions. We share Thonhauser’s objective to provide a relevant framework for future empirical research, but this endeavour requires accounting for the broad range of implicit affective processes involved in emotion and human social cognition.

Figure 1*Scale of collective emotion*

Note. The four types of collective emotion distributed along a continuum of collectiveness. Gradient colors illustrate that there is no sharp boundary between types of collective emotion.

Group-based emotion. The weakest degree of collective emotion in our typology relates to non-interactive emotion alignment between members of a social group attending to the same group-relevant event. As mentioned before, group-based emotion occurs when individuals appraise an event similarly from the group's stance, without *necessarily*⁶ interacting with each other. In other words, group-based emotion involves emotional convergence between individuals bound by their social identity. As such, group-based emotion is collective in a weak, attributive sense, because partaking individuals form an abstract collective, without direct and reciprocal influence between them. For example, think of the joy of French TV viewers watching France's football team score against Croatia during the 2018 FIFA World Cup final. Because this sporting event involves a competition between two national teams, French TV viewers are likely to identify with their nation, leading them to appraise the game's events from a common group stance despite interpersonal differences. Consequently, French TV viewers, at that particular moment, show convergent and synchronous emotional responses, jumping and screaming with exultation. Note that this notion of collectiveness is closely related to Salmela's definition in terms of shared concerns (Salmela, 2014): French TV viewers share a moderately collective emotion. Here, however, we are interested in

⁶ Group-based emotion theory does not preclude either interacting with other individuals, or thinking about other individuals and how they feel. However, we stress that social interaction and awareness of other individuals and their emotions are not constitutive of this type of collective emotion.

characterizing the emotional dynamics within the group *during* the event: the group-based joy of French TV viewers allegedly relies on self-categorization (i.e., as French or French supporters), institutionalized norms (i.e., the specific unfolding of a football game) and entrainment to a common emotion elicitor (i.e., the French team scoring), but it does not rely on social interaction⁷. To sum up, the emotional responses of French TV viewers parallel each other, without involving any proper interpersonal dynamics within the group.

Common emotion. As compared to group-based emotion, common emotion relies on interactive emotion alignment with direct reciprocal coupling between individuals. Because partaking individuals stand within perceptual reach, they reciprocally influence each other, even unconsciously, through verbal and non-verbal cues. Therefore, unlike group-based emotion, the collective in a common emotion is not a social entity composed of abstract, remote individuals, but a specific set of individuals interacting with each other⁸. This difference in social settings relates to heightened social presence (Cui et al., 2013) and social influence via emotion contagion, social appraisal and orientation calibration. As mentioned before, such interaction mechanisms in turn predict group-level properties, such as amplitude regulation and cascades of emotional responses within the group. For example, consider this time a group of joyful French supporters attending the final at Loujniki stadium, or watching the game on TV together, so that they can hear each other's screams and see each other's smiles when the French team scores. In this example, partaking individuals are exposed to perceptual cues about emotional responses that constitute the group's emotional climate (de Rivera, 1992). Accordingly, the joy of the French supporters does not only reflect their emotional response to the game's events but also to each other's exultation, with the joy of other supporters

⁷ Hypothetically, individuals could be watching the game in complete isolation from one another. In reality, French TV viewers are not isolated from the world – broadcasting of sporting events actually provides viewers with on-going live feedback about the emotional response of the physical audience, such as close-ups on the faces of fellow supporters. Thus, our example represents a dynamic case of group-based emotion: individuals are coupled with a live physical audience, but this coupling is not reciprocal.

⁸ This difference is analogous to the distinction between two levels of analysis in collective emotion research: social groups and network clusters (van der Löwe & Parkinson, 2014). Group-based emotion involves members of social groups (i.e., categories of individuals with similar attributes), whereas common emotion involves clusters of interacting individuals (i.e., defined on the basis of actual relationships).

contributing to the shaping of their own joy in implicit and explicit ways. As a result of this mutually reinforcing feedback loop, these supporters are more aroused and their experience more intense and long-lasting than if they had watched the game alone. Compared to the group-based joy of lone French TV viewers, the common joy of the supporters jointly watching the game is properly collective, in that the pattern of joyful responses at the group-level emerges from their interdependency. This case illustrates that there is no sharp distinction between group-based and common collective emotions, as common emotion sometimes builds upon group-based appraisal. However, tokens of common emotion are not necessarily tokens of group-based emotion. For instance, the anger of commuters waiting for a late train is common to the group, and therefore collective, insofar as their emotional responses build up from each other: commuters fulminating, foot tapping and frowning convey their emotion so that they may individually become angrier for longer than had they been waiting for the late train alone. Nonetheless, this group-level pattern reflects private overlapping concerns (Salmela, 2012) and does not involve group-based appraisal. Lastly, note that individuals partaking in a common collective emotion may become reflectively aware of the emotion of other partaking individuals, thus, also involving reciprocal awareness of emotions in the group. However, this knowledge of the emotion of other individuals is not yet mutual, as partaking individuals need not be aware that others know of their emotion.

Mutual emotion. In comparison, individuals partaking in a mutual collective emotion are mutually aware that their emotion aligns with those of others: they know that their emotional responses synchronously converge in response to the same emotion-eliciting event and know that other individuals are aware of this fact too. As mentioned in Section 1, gaining such a mutual knowledge implies mutual attention, which in turn relies on direct reciprocal contact between partaking individuals. To illustrate this point, imagine two French supporters standing next to each other during the 2018 FIFA World Cup final. When the French team scores, their eyes meet and they instinctively grab each other's arms; in doing so, the two supporters acknowledge that they are feeling the same emotion at that specific moment. In other words, they become aware of the

collectiveness of their emotional experience, which marks the difference with lesser degrees of collective emotion. In addition, mutual awareness predicts prosocial behaviours and attitudes. Indeed, partaking individuals may engage in intentional communication about their collective emotion due to a motivation to establish a shared reality (Echterhoff et al., 2009). For example, the two French supporters could verbally communicate their feelings to each other and other supporters (i.e., social sharing of emotions, see Rimé, 2009), further enhancing consolidation, synchronization, amplitude regulation and cascades of emotional responses within the group. Further, mutual knowledge of emotion alignment may demonstrate common group membership, fostering interpersonal attraction and liking between partaking individuals. Note that mutual collective emotion is not bound to dyadic interaction and can arise in larger groups of individuals: partaking individuals could gain mutual knowledge about emotion alignment within a limited subset of individuals, while inferring that they also align with the rest of the group based on its emotional climate or the salience of common group membership.

“We” emotion. The highest degree of collective emotion in our typology refers to the emergence of a specific feeling of connectedness arising from emotion alignment and mutual awareness thereof. In “we” emotion, partaking individuals shift from a singular to a plural first-person emotional experience. Partaking individuals not only feel the same, they feel as one, reflecting the emergence of a shared collective identity (Reicher & Drury, 2010). Note that this process differs from group identification occurring in lesser degrees of collective emotion. As argued by Neville and Reicher (2011), shared identity is distinct from social identity resulting from self-categorization: individuals share a collective identity as members of a common *embodied* group (i.e., the group of French or French supporters under mutual and reciprocal influences), and this shared identity is the basis of further prosocial attitudes and behaviours. Firstly, “we” collective emotion predicts implicit or explicit commitments of partaking individuals to further express emotions that are congruent with their shared identity (see Gilbert, 2002 for a discussion of collective emotions in terms of such commitments), again enhancing consolidation, synchronization, amplitude regulation

and cascades of emotional responses within the group. Secondly, “we” collective emotion predicts the reinforcement of social cohesion within the group: compliance to the group’s norms, production of symbols and solidarity (Rosner & Meher, 2014; Collins, 2014). Last but not least, “we” collective emotion provides the group of partaking individuals with reasons for collective action and facilitates joint action (Salmela & Nagatsu, 2016). This consequence of “we” collective emotion is obvious in social movements (e.g., Van Ness & Summers-Effler, 2018), where shared identity refers to changes in both intragroup and intergroup relationships motivating collective action (Neville & Reicher, 2011). Returning to the victory of France at the 2018 FIFA World Cup final, French supporters who experience a “we” emotion typically embrace each other, and verbally express their collective identity (e.g., “We did it, we won!”). They also cooperate to act as one, parading together in the streets, chanting and dancing in rhythm and carrying their champions in the air. The positive collective emotion of the supporters may also support the emergence of more complex sentiments, such as national pride. In other words, “we” emotion contributes to reinforcing collective identity and vice versa, hence, forming a positive feedback loop.

Table 1*Characteristics of different types of collective emotion*

Main characteristic	Group-based emotion	Common emotion	Mutual emotion	“We” emotion
Non-interactive emotion alignment	*	-	*	*
Interactive emotion alignment	-	*	*	*
Mutual awareness	-	-	*	*
Feeling of connectedness	-	-	-	*

Note. * indicates that the characteristic is necessary for this type of collective emotion.

In summary, we distinguished between four types of collective emotions, from low to high degrees of collectiveness, based on the categories of social and cognitive processes involved (see Table 1). Group-based collective emotion refers essentially to non-interactive emotion alignment via group identification; common collective emotion refers to interactive emotion alignment through implicit or explicit social influence; mutual collective emotion involves mutual co-representation of emotion or awareness of the collective nature of the emotional episode; “we” emotion refers to the experience of social connectedness with the emergence of a collective identity.

Our typology based on social and cognitive processes complements Salmela’s typology based on shared concerns (Salmela, 2012): an emotion can be weakly collective in terms of shared concerns and, inversely, strongly collective in terms of social and cognitive processes. To give but one example, the fear of private brokers during a market crash is weakly collective (i.e., it involves private overlapping concerns), but it refers to a wide range of situations and degrees of collectiveness when considering the unfolding of social and cognitive processes. Brokers can experience common

collective fear as they reciprocally influence each other without mutual awareness, mutual collective fear as they mutually acknowledge their aligned emotional responses to the economic turmoil, and “we” collective fear as they identify with each other and feel part of a larger emoting group. Note that in the latter case, strongly shared concerns among the brokers emerge as a consequence of the collective emotional episode rather than being its antecedent. Conversely, the mutual collective fear of the brokers may refer to different modes of sharing concerns, as they may practise independently (and actually compete with each other) or as part of a cooperative work team with explicit commitments to socially shared concerns. Thus, we suggest that these two typologies of collective emotion are orthogonal⁹ and we encourage future research to closely examine the relation between these two dimensions of emotional collectiveness.

Finally, our typology underscores the complementarity of different theoretical foci and encompasses different paradigmatic cases of collective emotions, such as interacting face-to-face, co-attending to an event side by side, or interacting through communication technologies. Beyond the traditional distinction between minimalist and maximalist accounts of collective emotion, this approach hints at a dynamic interplay of social and cognitive processes across the different degrees of collective emotion. As such, our typology makes testable predictions regarding mechanisms and outcomes of different degrees of collective emotion, hence, allowing for an evidence-based approach. In the spirit of this approach, we now turn to available empirical evidence in social cognition and affective sciences.

3. Review of empirical evidence

In the present section, we review empirical evidence about the candidate social and cognitive processes of collective emotion, in line with its three main characteristics: emotion alignment, feeling

⁹ However, we acknowledge a difference between the scopes of these typologies. According to Salmela (2012), mutual awareness is constitutive of collective emotion independently from its degree of collectiveness. In comparison, our typology conceives of mutual awareness as a defining feature of specific degrees of collective emotion (i.e., mutual and “we” emotions).

of connectedness and mutual awareness. This review aims at providing an overview of a range of relevant research fields for the study of collective emotion but does not claim to be exhaustive. Research on social presence and shared experience (Sub-section 3.1), emotional convergence (Sub-section 3.2) and interpersonal synchrony (Sub-section 3.3) sheds light on emotion alignment; research on empathic accuracy (Sub-section 3.4) and emotional aperture (Sub-section 3.5) investigates explicit awareness of emotion; research on collective effervescence and self-other blurring (Sub-section 3.6) provides information about the feeling of social connectedness.

3.1. Social presence and shared experience

Research on social presence and shared experience sheds light on the emergence of some of the group-level emotional patterns that define collective emotion (Section 1). Emotions are sometimes considered purely social phenomena that reflect influences from the social context (Parkinson, 1996; Greenaway et al., 2018; Fischer et al., 2003), including the presence of other individuals. Indeed, the felt presence of other individuals, or social presence (Cui et al., 2013), amplifies our subjective experience (Boothby et al., 2014): participants playing a game reported experiencing more fun (Reis et al., 2017), and participants facing a stressful test reported experiencing more stress (Nahleen et al., 2019) when they were undergoing the task together with another individual. Crucially, merely believing that other individuals are physically co-located and co-attending (i.e., simultaneously attending to the same event) modulates emotional responses, even in the absence of a social interaction. In a seminal electromyography study, Fridlund (1991) observed enhanced smiling activity when participants watched pleasant videos with a friend, or when believing that a friend was simultaneously watching the same videos in an adjacent room, as compared to explicit solitary viewing. Subsequent studies found that the effects of co-attention on emotions are not restricted to their communicative function. For example, Jakobs and colleagues (1996) showed that imagining experiencing an emotion in public or private contexts prompted higher self-reported happiness and anger in public contexts and higher self-reported fear and sadness in private contexts.

In sum, amplification of emotional experiences due to social presence does not necessarily imply that the experience is actually shared.

What are the cognitive processes underlying the effects of social presence on subjective experience? On the one hand, amplification of subjective evaluations during shared experiences positively correlated with increased mentalizing, indexed by self-reported thinking about the thoughts and feelings of other individuals (Boothby et al., 2014; Nahleen et al., 2019). On the other hand, amplification positively related to increased allocation of attention and increased processing of stimuli (Shteynberg et al., 2014). A recent electroencephalogram (EEG) study supports this argument demonstrating increased allocation of attention to emotional facial expressions when these expressions were perceived with other individuals versus alone, regardless of emotional valence (Schiano Lomorellio et al., 2020). Overall, previous research suggests that amplification effects significantly depend on the psychological or social distance between participants (Boothby et al., 2016). In particular, studies found significantly larger effects for natural groups of friends than for unacquainted individuals (Reis et al., 2017) and minimal groups (Shteynberg, 2018), and amplification increased with perceived similarity (Shteynberg, 2010).

Furthermore, the effects of social presence are not limited to amplifying shared emotional experiences: the presence of other individuals can also buffer negative experiences (Beaurenaut et al., 2021; Kikusui et al., 2006; Tedeschi et al., 2021). Valence ratings of negative and positive emotional pictures were less negative when participants were told that a friend was co-attending to the same picture compared to a different one (Wagner et al., 2015). A subsequent study found that this effect was related to increased activity in the reward circuitry (i.e., ventral striatum and medial orbitofrontal cortex), congruent with the observation that shared experiences are more enjoyable, even when they involve being frightened (Andersen et al., 2020).

In short, previous research supported the idea that shared experiences, including emotional experiences, are socially regulated and that perceived social distance between individuals modulates these effects. In particular, social presence and (perceived) co-attention contribute to the emergence

of group-level patterns pertaining to up- and down-regulation of emotional responses (i.e., amplification or buffering). These effects are observed even in contexts devoid of reciprocal social interaction, which characterize some episodes of group-based collective emotion. Lastly, shared emotional experiences predict some of the defining features of social relationships: for instance, shared experiences of positive affect between spouses discussing together predicted their marital quality (Brown et al., 2021).

3.2. Emotional convergence

Another characteristic of collective emotion is emotional convergence, defined as a decrease in interpersonal variability of emotional responses (Sub-section 1.1). The literature on collective emotion suggests that individuals emotionally converge in various social settings as a result of different mechanisms pertaining to social identification and social interaction (see Section 1.1).

To begin with identification mechanisms, group-based appraisal (i.e., appraisal of a situation based on social identity) explains emotional convergence independently of social interaction. Previous research confirmed that the emotions of individuals primed with a similar social identity tended to converge towards explicit stereotypical emotions, and that this convergence positively correlated with the strength of their social identification (Seger et al., 2009). Moreover, researchers found evidence for a bidirectional relationship between group identification and emotional convergence: self-categorization as a group member positively predicted emotional convergence and convergence positively predicted group identification (Delvaux, 2015), even in the case of artificially-induced group membership (Livingstone et al., 2011).

Regarding interaction mechanisms, previous research indicates that emotional convergence occurs when individuals who experienced an emotion verbally communicated their feelings to other individuals. Emotional convergence due to social sharing of emotion (Rimé, 2009) has been observed in laboratory settings during face-to-face interaction (e.g., Zheng et al., 2020) and text-based discussion, even when the emotion of the individuals sharing their experience is opaque to the receivers (Guillory et al., 2011). Crucially, emotional convergence within groups of three participants

had effects on the group's performances only when convergence involved interaction (i.e., social sharing of emotion, group task) (Klep et al., 2011), which further motivates the distinction between non-interactive group-based emotion and higher degrees of collective emotion. Furthermore, individuals also emotionally converge due to the implicit processing of non-verbal cues. As an example, Dezecache and collaborators (2013) revealed that convergence between individuals does not require intentional communication. Recorded displays of joy and fear elicited congruent electrodermal and facial muscle activity in participants who never saw these emotional displays, but instead only watched another participant responding to them, and even when the emotion of the mediating participant could not be explicitly recognized. These results suggest that emotional convergence relies on the spontaneous and implicit facial mimicry of emotional expressions¹⁰.

Previous research also suggests that emotional convergence results from the combination of identification and interaction mechanisms. For example, participants spontaneously mimicked happiness displays of other individuals, yet mimicked sadness displays only when the expresser was a fellow group member (Bourgeois & Hess, 2008)¹¹. In other words, mimicry and appraisal of emotional facial expressions preferentially occurs when common group membership is salient to individuals. In addition, comparison between dyads of friends and strangers simultaneously watching emotional film clips together revealed that friends converged in self-reported emotion to a greater extent than strangers, and that convergence between self-reported emotions was higher for amusing films when participants could see each other than when they could not (Bruder et al., 2012). Notably, the effects of social identification on emotional convergence during minimalistic social interaction (i.e., direct observation or co-attention) is not limited to positive emotional contexts. Participants exhibited higher levels of cortisol when observing another individual undergoing a stressful test after

¹⁰ Facial mimicry is the focus of divergent theoretical frameworks, including the facial feedback hypothesis, the social context theory and the perception action model (for an overview and a meta-analysis, see Holland et al., 2020).

¹¹ These findings have been discussed as evidence that mimicry-based emotional convergence relies on contextual interpretation of the expresser's emotional expression, similar to social appraisal rather than automatic contagion (Parkinson, 2019; Fischer & Hess, 2017).

experimental induction of common group identification as compared with a control group, although subjective levels of stress did not differ (Schury et al., 2020). Overall, these findings are in line with longitudinal studies of affective convergence occurring in natural social networks (e.g., Fowler & Christakis, 2008), such as work teams¹² (e.g., Tanghe et al., 2010; Delvaux et al., 2015) and online communities (Garcia & Rimé, 2019; for a review, see Goldenberg & Gross, 2020).

In short, previous research demonstrates that emotional convergence assessed at the behavioural, autonomic and hormonal levels is contextual (i.e., it depends on social identification and emotional valence) and sometimes implicit (i.e., individuals need not be reflexively aware of the emotion of the other individuals). Further, available empirical evidence supports the hypothesis that emotional convergence can result from the combination of identification and interaction mechanisms, which is congruent with our description of common, mutual and “we” collective emotions. Psychological research on emotional convergence has been at the core of agent-based models of collective emotion (e.g., Garcia et al., 2017) exploring the temporal dynamics of emotion alignment, including the synchronicity of emotional responses.

3.3. Interpersonal synchrony

Interpersonal synchrony arises either independently from social interaction (i.e., externally-driven synchrony), or due to direct coupling between individuals (Nummenmaa et al., 2018). Here, we review empirical evidence regarding the latter type of synchrony occurring at the behavioural, autonomic and cerebral levels.

Behavioural synchrony is a prominent feature of collective emotional gatherings (Knottnerus, 2015). Extensive research has identified the positive individual and social outcomes of synchronicity in movements and vocalizations (see Rennung & Göritz, 2016 and Mogan et al., 2017 for meta-

¹² Notably, work teams converged despite role asymmetries between team leaders and other team members. Tanghe and colleagues (2010) mention two possible explanations: individuals strongly identifying with the group, such as team leaders, could either influence fellow group members to a greater extent, or conversely adjust their own affect given the self-relevance of emotional cues within the group. These hypotheses underscore how emotion convergence can be directional within groups of individuals characterized by unequal distribution of social influence.

analyses of these effects), such as elevated pain threshold (Cohen et al., 2010; Tarr et al., 2015), positive affect (Tschacher et al., 2014), cooperation (Wiltermuth & Heath, 2009) and affiliation (Hove & Risen, 2009). Empirical evidence also indicates that synchronicity in facial expressions of emotion occurs spontaneously and relates to positive social outcomes. For instance, temporal alignment and congruency of facial emotion expressions during co-viewing of a TV show positively predicted self-reported social connection between co-viewers (Cheong et al., 2020). Similarly, temporally aligned laughter in response to affective stimuli predicted relationship satisfaction (Kurtz & Algoe, 2017).

What are the cognitive mechanisms underlying the prosocial effects of behavioural synchrony? In their meta-analysis, Mogan and colleagues (2017) showed that the effects of behavioural synchrony varied with the size of the group: group size positively predicted prosocial behaviour and positive affect, but not social cognition and perceived social bonding. These results were interpreted as evidence supporting a distinction between different mechanisms: in small groups, behavioural synchrony would signal to synchronized individuals that they share goals and promote social attention; in large groups, behavioural synchrony would foster collective effervescence including increases in bodily and emotional arousal. A recent experimental study manipulating motoric synchrony and bodily arousal in large groups (i.e., 40-50 participants) found evidence that cohesion and cooperation increased when motoric synchronicity was paired with 'high' bodily arousal (Jackson et al., 2021).

Autonomic synchrony is the interpersonal co-variation in the activity of the parasympathetic and sympathetic nervous systems regulating, among others, respiration and heartbeat (see Palumbo et al., 2017 for a review). A recent meta-analysis revealed that autonomic synchrony is positively but weakly related to positive relationship outcomes and group performance (Mayo et al., 2021). For instance, autonomic synchrony predicted marital satisfaction between spouses (Levenson & Gottman, 1983; Chen et al., 2020), as well as affiliation, attraction (e.g., Golland et al., 2019; Prochazkova et al., 2021), or cooperation (Behrens et al., 2020) between strangers. Crucially for research on collective emotion, autonomic synchrony also reflects emotion alignment: similarity in

self-reported emotion positively correlated with cardiac synchrony between unacquainted spectators attending a theatrical performance (Ardizzi et al., 2020) and with electrodermal, cardiac and zygomatic synchrony in watching emotional film clips (Golland et al., 2015; 2019). Thus, autonomic synchrony sometimes reflects alignment in emotional experiences that positively predicts affiliation (Golland et al., 2019). These experimental results are congruent with the hypothesis that interpersonal autonomic synchrony is a biological correlate of collective emotion, although further research is needed to specify the causal relation between these phenomena.

Controlled experimental studies found that autonomic synchrony varied according to the emotion elicited in participants and their pre-existing relation (e.g., Bizzego et al., 2019). However, evidence regarding the influence of the relationship between participants is mixed. On the one hand, greater cardiac synchrony was observed between strangers than between friends and lovers (Bizzego et al., 2019), and between participants primed with dissimilarity rather than similarity (Danyluck & Page-Gould, 2018). On the other hand, a physiological study of a fire-walking ritual detected significant levels of cardiac synchrony between fire-walkers and audience members (i.e., in the absence of behavioural coordination), but only when performers and spectators were related family members, implying that autonomic synchrony is related to empathy driven by kinship (Konvalinka et al., 2011). These discrepant results highlight the importance of additional considerations concerning communication modality (e.g., verbal vs. non-verbal), autonomic channels (e.g., sympathetic vs. parasympathetic) and type of synchrony (e.g., in-phase vs. anti-phase) in order to interpret autonomic synchrony (Danyluck & Page-Gould, 2019).

Cerebral synchrony is the topic of a bustling field of research underscoring its role in social coordination, cohesion and group performance (Shamay-Tsoory et al., 2019; Dikker et al., 2021; Reiner et al., 2021). For example, previous research using hyperscanning EEG demonstrated that interbrain synchrony (IBS) is positively related to motor coordination and empathy in different neural regions (Djalovski et al., 2021). In addition, levels of cerebral synchrony varied with social distance between interacting partners (Djalovski et al., 2021; Kinreich et al., 2017), suggesting that cerebral

synchrony reflects social connectedness. Indeed, available empirical evidence indicates that cerebral synchrony positively relates to explicit representation of other individuals: perceived self-other overlap and cerebral synchrony in the right dorsolateral prefrontal cortex positively mediated the prosocial effects of dyadic motoric synchrony (Feng et al., 2020). In addition, cerebral synchrony positively correlated with accuracy in inferring pain (Goldstein et al., 2018) and with convergence in self-reported emotion when the partner's emotion was accurately recognized (Anders et al., 2020). These findings suggest that interpersonal cerebral synchrony is a biological correlate of the accurate and explicit representation of other's emotions, or empathic accuracy (see Section 3.4).

Overall, previous research on interpersonal synchrony highlights its positive effects on prosocial attitudes and behaviours and demonstrates its variability according to social and affective contexts (i.e., level of arousal, social distance). For these reasons, we do not expect interpersonal synchrony to characterize specific types of collective emotion, but predict that it will increase with the degree of collectiveness as a function of reciprocal social influence. Moreover, the scientific literature suggests that interpersonal synchrony relates to other candidate processes of collective emotion, such as empathic accuracy and collective effervescence.

3.4. Empathic accuracy

Empathic accuracy is the ability to accurately identify the thoughts and feelings of other individuals (Ickes, 2009; 2016)¹³. Research on empathic accuracy investigates what we have been referring to as awareness of others' emotions (Sub-section 1.3). Different factors modulate empathic accuracy: communication modality, emotional valence, traits of the perceiver, expressivity of the target, and the perceiver-target relation. Firstly, previous studies contrasted conditions including visual information only, auditory information only, auditory and verbal information or a combination

¹³ Experimental studies of empathic accuracy mainly relied on the dyadic interaction paradigm (Ickes et al., 1990), in which participants interact with each other and then later watch a video recording of their interaction to report their own feelings and infer those of their interaction partner. Independent judges then compare actual and inferred feelings to yield an accuracy score ranging from 0 to 100. Another experimental paradigm dissociates perceiver and target, so that participants infer the thoughts and feelings of other target participants.

of these. A consensus emerged, indicating that verbal cues contributed most to accuracy, followed by paralinguistic cues, with visual non-verbal cues contributing the least (Gesn & Ickes, 1999; Hall & Mast, 2007; Jospe et al., 2020). Regarding emotional valence, previous research revealed that accuracy was greater for recognition of positive compared to negative emotions (Campos et al., 2020). As for the traits of the perceiver, gender differences in empathic accuracy reflect gender-based differences in motivation and conformism to social roles rather than differences in empathic abilities (Ickes, 2016; Laurent & Hodge, 2009). Furthermore, accuracy in emotion recognition related to the perceiver's self-reported tendency for perspective-taking (Israelashvili et al., 2019), as well as self-reported affective empathy when targets were expressive (Zaki et al., 2008). Indeed, the expressivity of the target – and in particular the production of verbal cues – was found to predict empathic accuracy to a greater extent than the perceiver's motivation or ability (Ickes, 2016). In addition, empathic accuracy decreased with social distance between the perceiver and the target: “strangers infer each other's actual (non-randomly paired) thoughts and feelings with an average accuracy score of about 20%; close friends make these inferences with an average accuracy score of about 30%; and married couples achieve average accuracy scores that usually range no higher than 35%” (Ickes, 2016; p. 55). Further evidence suggests that social distance biases the inference of thoughts and feelings: accuracy and speed in emotion recognition increased with social and cultural proximity between perceiver and target (Elfenbein & Ambady, 2002 – but see Soto & Levenson, 2009). Other studies found a relation between this in-group advantage and increased exposure to in-group members (Elfenbein, 2006), as well as the perceiver's self-reported attentional focus and physical attraction to an opposite-sex target (Ickes et al., 1990). The latter finding supports the hypothesis that the relation between perceiver and target modulates empathic accuracy through attentional and motivational processes.

What are the other processes underlying empathic accuracy? On the one hand, previous research suggests that empathic accuracy relies, to some extent, on interpersonal emotional alignment between perceiver and target. Indeed, perceivers, whose ability to produce facial

expressions was impaired with a gel facemask, showed lower accuracy in emotion recognition of targets' facial expressions (Wood et al., 2016). A study involving Transcranial Magnetic Stimulation (TMS) found similar evidence: accuracy in discriminating fake from real smiles decreased with disruptive stimulation of sensorimotor brain areas (underlying the perception and simulation of other's movements), but not with disruptive stimulation of brain areas involved in mentalizing (supporting the ability to infer the thoughts and feelings of others) (Paracampo et al., 2017). Moreover, deficits in empathetic abilities are associated with alexithymia, characterized by difficulties identifying and verbalizing one's own feelings (Preece et al., 2020; Valdespino et al., 2017). These findings are compatible with the view that empathic accuracy relies on a simulation of the target's emotions, which can, for instance, translate into facial mimicry. Moreover, interpersonal autonomic synchrony between spouses during face-to-face interaction positively correlated with empathic accuracy (Levenson & Ruef, 1992). On the other hand, previous research also demonstrates that accuracy in emotion recognition does not rely on emotion alignment between perceiver and target. Unlike the aforementioned TMS study, a functional Magnetic Resonance Imaging (fMRI) study investigating the neural correlates of empathic accuracy showed a positive correlation with activations in areas involved in mentalizing, such as the superior temporal sulcus, the temporoparietal junction and the temporal pole, as opposed to areas involved in sensorimotor representations (Mackes et al., 2018). In addition, studies pointed to dissociations between interpersonal autonomic synchrony and empathic accuracy (Soto & Levenson, 2009). For instance, cardiac synchrony between strangers increased under attentional focus to visual non-verbal cues, whereas empathic accuracy increased with availability of verbal cues, as mentioned earlier (Jospe et al., 2020).

In short, empathic accuracy decreases with social distance and increases with the exchange of verbal cues between perceiver and target. Crucially, both have been described as features of collective emotional episodes, especially considering the social sharing of emotion that characterizes mutual and "we" collective emotions in our typology. However, to the best of our knowledge,

empathic accuracy has never been assessed in a bidirectional fashion as a marker of reciprocal explicit awareness of emotion. Moreover, the processes underlying attribution of emotions to other individuals may greatly differ in social settings involving large groups of individuals.

3.5. Emotional aperture

When collective emotional episodes extend beyond a dyadic relation, explicit awareness of other individuals and their emotions (Sub-section 1.3) can be measured in terms of emotional aperture, defined as the ability to accurately infer the emotional composition of a group (Sanchez-Burks & Huy, 2009). Research on emotional aperture found that participants asked to evaluate the emotional composition of a group of individuals tended to focus their attention on a few individuals (Masuda et al., 2008), and in particular those expressing more intense emotions, which led to an overestimation of the group's average emotional intensity (Goldenberg et al., 2021).

Like empathic accuracy, emotional aperture has been shown to vary with the traits of the perceiver and the perceiver-target relation. A recent study that investigated the hypothesis that emotional aperture is a culture-dependent ability, found that individuals from collectivist cultures (i.e., Chinese participants) were more accurate than individuals from individualistic cultures (i.e., American participants) at inferring the emotional composition of a group, relying more on global, as opposed to local visual processing (Yang et al., 2019). Furthermore, emotional aperture is subject to in-group bias: participants overestimated the negative emotions and underestimated the positive emotions of outgroup members (Seger et al., 2009).

In light of the aforementioned evidence regarding emotional convergence (see Sub-section 3.2), emotional aperture could constitute a prerequisite for successful emotional convergence based on social appraisal in large groups. Moreover, perception of emotional convergence within a group was found to positively predict inferences of psychological closeness between group members and a shared common fate (Magee & Tiedens, 2006). Therefore, emotional aperture could also serve as a basis for the experience of social connectedness that characterizes higher degrees of collective emotion in our typology.

3.6. Social connectedness

The feeling of connectedness that characterizes the experiential quality of collective emotion (Sub-section 1.2) is the focus of research on collective effervescence and identity fusion. Ritualistic theories describe collective gatherings as prototypical occurrences of collective emotion involving in-group emotion alignment, behavioural synchrony, rhythmic entrainment, mutual awareness with joint attention and collective effervescence (Rosner & Meher, 2014; Knottnerus, 2010). Research on collective effervescence therefore integrates several of the aforementioned fields of research with the central claim that collective effervescence, including a feeling of social connectedness or sense of togetherness, mediates the relation between emotion alignment and the reinforcement of social cohesion within the group. Previous research has indeed confirmed that perceived emotion alignment mediates the relation between participation in collective gatherings (e.g., folkloric marches, political demonstrations) and social outcomes, such as identity fusion, the feeling of belonging and collective self-esteem (Páez et al., 2015; Włodarczyk et al., 2021). These results suggest that group-level emotional patterns, and awareness thereof, are pre-requisites for the experience of social connectedness.

What are the mechanistic bases of social connectedness? First, as mentioned in Section 1.2, social attention may underlie mutual awareness of emotion alignment during such collective events. Supportive evidence comes from an experimental study contrasting groups of participants co-attending to film clips on the same screen to those present in the same room but watching the film clips on individual laptops: despite a decrease in perceived similarity and liking of other group members when participants individually watched negative, as opposed to neutral film clips, measures of social connectedness increased when participants jointly watched the negative film clips compared to other conditions (Rennung & Göriz, 2015)¹⁴. Second, empirical evidence has linked social connectedness with autonomic activation: periods of high self-reported togetherness within

¹⁴ This study also hints at the intriguing possibility that the enjoyment of negative emotional experience (e.g., watching horror films and attending tragic plays in the cinema and theatre) is not only a function of individual psychological processes (Menninghaus et al., 2017) but also involves interpersonal processes.

dyads were marked by an increase in participants' heart rate, which could be interpreted as evidence for enhanced enjoyment and engagement during joint tasks (Noy et al., 2015). Moreover, autonomic activation positively predicted the extent of meaning-making reflection that is typical of imagistic rituals (Richert et al., 2005) and, ultimately, autonomic activation enhanced the relation between identity fusion and pro-group behaviours (Swann et al., 2012).

In short, empirical evidence supports models of collective effervescence that posit the contribution of mutual attentional focus and increased autonomic activation. However, further research is needed to identify the relation between these different mechanisms and the dynamic emotional experience of individuals reporting social connectedness.

In this section, we linked hypotheses about mechanisms of collective emotion with available empirical evidence in different fields of research. Overall, the scientific literature provides evidence that these different mechanisms contribute to the emergence of group-level emotional patterns that characterize collective emotion: shared experience and in particular felt presence of co-attending individuals drives up- and down-regulation of emotional responses (Sub-section 3.1); group-based appraisal, mimicry and social sharing of emotion contribute to emotional convergence that corresponds to consolidation of emotional responses (Sub-section 3.2); research on interpersonal synchrony at the behavioural, autonomic and cerebral levels yields knowledge about the biological correlates and prosocial effects of the synchronization of emotional responses (Sub-section 3.3); research on empathic accuracy and emotional aperture elucidates the mechanisms underlying explicit awareness of the emotions of other individuals (Sub-sections 3.4 and 3.5); research on collective effervescence connects different candidate mechanisms into a functional framework (Sub-section 3.6). Moreover, the aforementioned studies point to the existence of common contextual factors: (i) social distance between partaking individuals, including kinship, friendship and experimentally induced group identification; (ii) emotional characteristics of the context, such as valence and arousal; (iii) modality of the social interaction, such as communication modality and group size. Crucially, combinations of such factors predict changes in the aforementioned

mechanisms that are congruent with our typology of collective emotion. However, overlap between these research areas in the context of collective emotion remains fairly exceptional, which calls for developing a framework fostering systematic empirical investigation of collective emotion.

Conclusion and future directions

To conclude, we propose to address theoretical and methodological heterogeneity in research on collective emotion by specifying the main social and cognitive processes involved. The interplay between these processes yields a typology consisting of four degrees of collective emotion that highlights commonalities between different traditions of research on this topic. Based on this typology, we formulated empirical predictions about the mechanisms, factors and social consequences of collective emotion and turned to available empirical evidence in social cognition and affective sciences.

Based on this approach, we outline here several questions for future research. What is the relation between the three main characteristics of collective emotion (i.e., emotion alignment, feeling of connectedness, mutual awareness)? Are there continuous empirical measures reflecting changes in degree of emotional collectiveness (e.g., alignment of emotional experiences, autonomic and cerebral synchrony)? What are the neural correlates of collective emotion? What are the temporal dynamics (e.g., time scale, directionality) and the exact social outcomes (e.g., social cohesion, cooperation) of collective emotion given the degree of emotional collectiveness and the socio-affective context (e.g., spatial and social distance between individuals, group size, levels of arousal and behavioural synchronicity)? In particular, how does our typology of collective emotion relate to typologies of joint action?¹⁵ What are some of the negative consequences of collective emotions?¹⁶ What individual traits and cultural factors account for variability in experiencing

¹⁵ Future research could compare the relation between specific types of collective emotion and specific types of joint action (Pacherie, 2014). For example, does “we” collective emotion (i.e., feeling as one) foster collective action characterized by united agency (i.e., the sense of acting as one)?

¹⁶ Contemporary research on collective emotion mainly stresses its adaptive social role, although collective emotions may sometimes have detrimental personal and social effects. See Gelfand and colleagues (2020) for

collective emotion? A major challenge for research on collective emotion is testing the central assumption that collective emotion fulfils social functions. Indeed, we reviewed empirical evidence highlighting the prosocial attitudinal and behavioural effects of social identification, emotion alignment, interpersonal synchrony, social sharing of emotion and the feeling of social connectedness. Hence, the question arises whether collective emotion resulting from combinations of these phenomena results in adaptive social outcomes above and beyond the aforementioned effects.

To address these pressing questions, we call for an integrative framework combining empirical field studies and experimental research in laboratory settings. To date, field-based work on collective ritualistic events in the social sciences has yielded fundamental insights into group dynamics in affective contexts. However, their ecological validity comes at the expense of accuracy in probing the implicit cognitive mechanisms occurring during collective emotion. It is therefore difficult to generalize ritualistic models to explain the occurrence and outcomes of collective emotion in other social settings. We propose that a fruitful research program would complement this research with experimental studies manipulating the socio-affective context during joint experimental tasks. Based on our review of the scientific literature, we have identified relevant independent and dependent variables that are likely to modulate and characterize different types of collective emotion (see Figure 2). The proposed research program has the advantage of capitalizing on existing empirical measures, while combining them into dyad- or group-level indices measuring changes during the collective emotional episode.

Finally, we stress the promising implications of experimental research on collective emotion. To start with, the theoretical literature on collective emotion calls for dedicated empirical research to put to test the assumptions and predictions of existing accounts. Furthermore, the experimental study of collective emotion would contribute to extending empirical research in affective sciences

a related discussion and a review of the anti-social effects of ritualistic synchrony (e.g., destructive obedience, diminished creativity).

848 and social cognition towards group-level affective phenomena that characterize human ecologies
849 (van Kleef & Fischer, 2016; Schilbach et al., 2013b). Overall, this research program is likely to benefit
850 broader research in the social sciences and real-world applications by integrating different levels of
851 analysis into a multidisciplinary framework (Whitehouse, 2021; Todorov et al., 2006). We believe this
852 endeavour is crucial if we aim for a better understanding of human attachment, collective behaviours
853 and their transformation in modern society (Bak-Coleman et al., 2021).

854

Figure 2*Relevant experimental variables for the study of collective emotion*

Note. Dependent variables (a) to (d) refer to characteristics of collective emotion, whereas dependent variables (e) and (f) refer to candidate social consequences. This list is not exhaustive.

* These variables denote individual-level measures that are then respectively aggregated into group-level indices.

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