

THE COMMUNICATION OF MELANCHOLY, GRIEF, AND FEAR IN DANCE WITH AND WITHOUT MUSIC

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Abstract: *Professional dancers were video recorded dancing with the intention of expressing melancholy, grief, or fear. We used these recordings as stimuli in two studies designed to investigate the perception and sociality of melancholy, grief, and fear expressions during unimodal (dancing in silence) and multimodal (dancing to music) conditions. In Study 1, viewers rated their perceptions of social connection among the dancers in these videos. In Study 2, the same videos were coded for the amount of time that dancers spent in physical contact. Results revealed that dancers expressing grief and fear exhibited more social interactions than dancers expressing melancholy. Combined with the findings of Warrenburg (2020b, 2020c), results support the idea that—in an artistic context—grief and fear are expressed with overt emotional displays, whereas melancholy is expressed with covert emotional displays.*

Keywords: *dance, multimodality, emotional expressions, perception, sociality.*

INTRODUCTION

An attunement to emotions experienced by others is essential for human well-being and survival. In general, emotion perception facilitates understanding of the emotions, actions, and sensations of others. Emotions are thought to have an evolutionary past: They function to change our behavior, and such behaviors can provide valuable information to others about the environment as well as possibly influence how others behave (Adolphs, 2017; Ekman, 1992; Keltner & Haidt, 1999; LeDoux & Hofmann, 2018). When people experience an emotion, related changes take place within their physiology and expressions. Some of these changes are common across cultures and some differ as a function of social learning, interoceptive cues, and environmental context (Barrett, 2017; Gross & Feldman Barrett, 2011; Russell, 2003; Tracy & Randles, 2011).

Historically, the study of emotion perception has emphasized one's ability to decipher others' facial expressions or vocal cues (e.g., Ekman & Friesen, 1975). Ekman and colleagues asked actors to make facial expressions of six emotions: surprise, happiness, sadness, disgust, anger, and fear. Researchers have asked people around the globe to match these facial expressions to specific emotional terms, such as sadness. The fact that people in many cultures have been successful in this task has given rise to the claim that some emotional expressions are universal (although see Barrett, 2017, for a refutation of this argument).

In the 21st century, emotion researchers tend to separate subjective feelings of emotion from emotional displays (see Warrenburg, 2020a, for a review comparing emotion theories in aesthetic and nonaesthetic scenarios). Feelings of sadness, for example, may sometimes be visible to others through behaviors such as crying and at other times may be undetectable by an observer. The act of crying may signal sadness, but also could indicate happiness (such as at weddings), fear, or relief. People also can control consciously some facial and bodily expressions, for instance, choosing to smile even when they are feeling sad. Therefore, in everyday life, there is no direct mapping between emotional behaviors or displays and the underlying affective feelings (Barrett, 2017; Russell, 2003).

In art forms such as dance and music, however, artists may rely on certain behaviors and expressions in order to convey emotions to their audiences. Some researchers believe that the emotions expressed and evoked when engaging in art, known as "aesthetic emotions" or "refined emotions," differ from "everyday" emotions (Frijda & Sundararajan, 2007; Juslin, 2013; Scherer, 2004). Characteristics of naturalistic movements—such as force, velocity, timing, and spatial orientation—can be used to express (and perceive) emotions in dance (Camurri, Lagerlöf, & Volpe, 2003; Camurri, Mazzarino, Ricchetti, Timmers, & Volpe, 2003; Van Dyck, Burger, & Orlandatou, 2019). Dances depicting grief, for example, tend to be performed at a relatively stable tempo, compared to dances expressing anger and fear, which contain more tempo changes (Camurri, Lagerlöf et al., 2003). People are able to discriminate emotions in dance performances even when the dancers use identical choreography (Camurri, Lagerlöf et al., 2003). In music, factors such as tempo, mode, dynamics, and articulation have been shown to vary among expressions of emotions such as fear, grief, and melancholy (Juslin & Sloboda, 2010; Warrenburg, 2020b).

Overt and Covert Emotional Displays

A subjective feeling state, like happiness or anger, emerges from a combination of processes, including underlying physiology and cognition, innate behaviors, learned associations and

previous experiences, and the physical and social environment (Barrett, 2017). Sometimes these affective feelings are accompanied by certain facial expressions (such as smiling), vocal characteristics (such as a breaking voice), bodily movements (such as jumping), or interpersonal behaviors (such as self-isolation). The physical manifestations that accompany a subjective feeling state are called “emotional displays.” Even though specific emotional displays do not correlate one-to-one with subjective feeling states, some affective states tend to be associated with easily observable displays and some with more subtle displays.

Two general types of emotional displays can accompany subjective feeling states: overt and covert (e.g., Huron, 2015, 2016). Overt displays refer to clearly communicated emotional displays, meaning that an observer usually can detect how the emotion experiencer is feeling. Emotions such as excitement or anguish, for example, often—but not always—are accompanied by facial expressions (smiling, crying), vocalizations (laughing, bawling), and bodily expressions (jumping up and down, curling into a fetal position). Covert displays, on the other hand, are difficult to detect by observers because these displays tend to be subtle or even invisible. For example, it is not easy to determine whether another person is experiencing love or jealousy unless the feelings or experiences are articulated directly.

Put succinctly, overt emotional displays can be used to elicit a response in an observer (Huron, 2016; Tomkins, 1980). After having suffered a death in the family, a grieving individual may need help or support from another person. Emotional displays such as crying can facilitate communication between the grieving person and an observer. Similarly, if a person is excited, it is often to that person’s advantage to let others know that their facial and bodily expressions represent feelings of happiness and friendliness, as opposed to displays of aggression (Ohala, 1994). Overt auditory and visual displays, then, make it easier for observers to interpret the experiencer’s emotions. When others respond, emotion experiencers can, in turn, more effectively regulate their affect.

Alternately, covert emotional displays typically do not result in social interactions. For example, when a person is feeling calm or jealous, obvious emotional expressions or behaviors that let observers know how the experiencer is feeling are missing. The lack of obvious emotional displays can be advantageous for these affective states. A person may wish to hide feelings of jealousy, for example, as jealousy could possibly hurt one’s social standing. Thus, because minimal visual or auditory displays are associated with affective states such as melancholy, jealousy, or love, it can be difficult for an observer to perceive accurately these affective states in another person.

In line with the idea that subjective feeling states can be separated from emotional displays, some affective feelings utilize both overt and covert displays. In expressing fear, for example, a person might project widened eyes, choose to run away, or simply freeze in place. Furthermore, the relative overtness of an emotional display is not categorical but continuous: In one instance, feelings of happiness might be accompanied by a smile, but at another time could be accompanied by both a smile and gesticulations. To summarize, then, emotional feelings in everyday life that utilize overt displays are inherently social, as these expressions tend to facilitate interactions with others.

We draw on the role of overt and covert emotional behaviors for our research. The goal of the current study was to study emotional displays in an aesthetic context: We studied how dancers use overt and covert displays to express emotions to an audience, as well as how observers interpret these displays.

Melancholy, Grief, and Fear

We selected melancholy, grief, and fear as the three target emotions because they are all negatively valenced emotions. These three emotions can also be accompanied by various emotional displays and expressions.

Researchers who study sadness often distinguish a low-energy sadness (melancholy) from a high-energy sadness (grief). Among the researchers who make this distinction, grief usually is defined as a negatively valenced emotion associated with high physiological arousal, whereas melancholy usually is defined as a negatively valenced emotion associated with low physiological arousal (Andrews & Thomson, 2009; Darwin, 1872; Urban, 1988; Vingerhoets & Cornelius, 2012). We use these definitions in the current study.

The functions of melancholy and grief, as well as their corresponding subjective feeling states and physiological displays, differ significantly. People experience grief after a significant loss, due to death, loss of safety, loss of autonomy, or loss of identity (Archer, 1999; Epstein, 2019). However, researchers disagree about the evolutionary purpose of grief. On one hand, according to Archer (1999), grief is a maladaptation. Archer's argument is that it is biologically important to form close personal relationships and to experience emotions like love and trust. When one of these relationships is lost, whether due to death or another circumstance, grief is experienced as a maladaptive side effect of the lost relationship; there is no useful purpose of grief.

On the other hand, some researchers argue that the function of grief is to solicit help, compassion, comfort, and prosocial responses from others in times of need (Huron, 2015, 2016; Urban, 1988; Vingerhoets & Cornelius, 2012). This theory of grief is driven by observations that when people are in a grieving state, they often exhibit conspicuous (overt), multimodal displays of emotion, including crying (visual), wailing (auditory), and pheromone release (olfactory; Frick, 1985; Gelstein et al., 2011; Mazo, 1994; Rosenblatt, Walsh, & Jackson, 1976; Urban, 1988; Vingerhoets & Cornelius, 2012). Observers easily understand that a person is grieving and therefore are able to respond to the grieving person with compassionate or prosocial behaviors.

In contrast, melancholy is a negatively valenced emotion associated with few—or no—overt emotional displays. When a person needs to self-reflect about a failed goal, melancholy may be the emotion experienced (Ekman, 1992). This self-reflection is a solitary activity that usually does not require the assistance of other people (Huron, 2015). Melancholic individuals therefore tend not to exhibit any conspicuous displays of emotion. Rather, behaviors and expressions associated with melancholy are simply effects of low physiological arousal: A melancholic person tends to be mute and display relaxed facial expressions (Andrews & Thomson, 2009; Nesse, 1991). Accordingly, it is difficult for an observer to differentiate among people in melancholic, bored, relaxed, or sleepy states, despite the differences in valence in these states (Andrews & Thomson, 2009; Nesse, 1991).

It is important to note that in the case of a significant loss, such as the death of a marital partner, a person is likely to experience both melancholy and grief. Psychic pain tends to involve alternating periods of quiescent melancholy and louder grief. This alternating pattern of melancholy and grief constitutes the mourning cycle (Huron, 2016).

Given the theoretical and behavioral differences between melancholy and grief, we propose that comparatively overt expressions of grief will result in higher levels of perceived sociality than the comparatively covert expressions of melancholy. Dancers expressing grief

may be more likely to interact with each other, increasing perceptions of prosociality. However, because melancholy tends to be a private, self-directed emotion, we expect that dancers expressing melancholy may exhibit comparatively fewer prosocial behaviors.

The third emotion examined in the current study is fear. Unlike grief, which typically is accompanied with overt emotional displays, fear can be accompanied by either overt or covert emotional displays, as indicated by the classic “fight, flight, or freeze” response. Several bodily responses to fear-induced adrenaline are involuntary and overt, such as trembling, which can affect the quality of the voice (Huron, 2015). On the other hand, some involuntary responses to fear are quite subtle and may not be noticeable to others, depending on their proximity and attention, such as pupil dilation (Leuchs, Schneider, Czisch, & Spoormaker, 2017) and shortness of breath (Milosevic & McCabe, 2015), while still others are primarily internal, including increased heart rate (Lang, Levin, Miller, & Kozak, 1983).

In some cases, overt displays of fear can provide benefits: As with grief, overt displays may encourage help from others. However, in the face of a threat, one often is advantaged by hiding expressions of fear, particularly when the threat comes from a human or animal that is able to interpret those signs. Therefore, the level of interpretability of emotional displays of fear is unclear. We included fear in the current study in order to investigate whether dancers use comparatively more covert or overt displays of fear and whether observers could discern fear relatively more easily (like grief) or less easily (like melancholy).

Multimodality

In the current study, participants were asked to rate both unimodal (dance-only) and multimodal (dance-music) videos. In multimodal situations involving music and dance, dance movements have been shown to express similar emotions as the accompanying music (Krumhansl & Schenk, 1997). For example, in prior studies, researchers asked participants to dance naturally to a series of musical samples while wearing motion capture sensors (Burger, Saarikallio, Luck, Thompson, & Toiviainen, 2013). Sad music correlated with fairly simple movements, low speeds, and little tension, whereas dancers used irregular and nonfluid movements when dancing to angry music. Multimodal presentations in aesthetic conditions, such as dance with accompanying music, are thought to facilitate emotional learning and perception, potentially leading to a higher accuracy in emotional perception than in dance-only or music-only conditions (Huron, 2016; Moreno & Mayer, 2007). With respect to this previous research, analysis of the current study will address whether multimodality enhances identification of the intended emotions in an aesthetic context.

HYPOTHESES

The current study was based on two primary goals. The first was to explore people’s accuracies in identifying expressions of three negative emotions in dance. Then we sought to determine whether the emotional expressions of the three emotions affected perceptions of sociality among the dancers.

Our first goal was to explore the relative accuracy in identifying expressions of melancholy, grief, and fear in dance. In Hypothesis 1, we proposed that emotions with overt

displays, like grief, would be detectable by observers, but emotions with covert displays, like melancholy, might not be identified as easily. However, for an emotion such as fear, which can be associated with either covert or overt displays, the level of interpretability might be unclear, and consequently, we did not make a directional prediction.

H1: Observers will be more accurate in their perception of grief than in their perception of melancholy in unimodal (dancing in silence) and multimodal (dancing to music) videos.

The second goal was to examine the relative degrees of sociality present in the performances of melancholy, grief, and fear in unimodal (dance-only) and multimodal (dance-music) conditions. As described in the Introduction, people expressing grief may exhibit more overt behaviors than people expressing melancholy, due to the theorized evolutionary function of grief to solicit compassionate or prosocial responses from other people (Huron, 2015, 2016). We quantified social behaviors expressed in uni- and multimodal dance videos using two methods. First, we used a rating task to examine the extent of sociality perceived by observers in videos expressing melancholy, grief, and fear (H2). Second, we quantified the amount of physical connection in videos of dancers expressing melancholy, grief, and fear (H3) by calculating the proportion of time that included physical touch among the dancers for each video. We did not make any a priori hypotheses about fear because of fear's mixture of both overt expressions (e.g., running away, eyes widening) and covert expressions (e.g., standing still).

H2: Observers will perceive more sociality in videos expressing grief than in videos expressing melancholy.

H3: Dancers will objectively exhibit more social behaviors when dancing to express grief than when dancing to express melancholy.

STUDY 1: PERCEPTIONS OF EMOTION AND SOCIALITY

Study 1 tested Hypotheses 1 and 2, which investigated the ability of observers to identify correctly an emotional expression and the amount of sociality perceived in its expression. We sought to determine if the outcomes are dependent on whether the target emotion utilizes overt or covert displays. Specifically, we predicted that overt displays (H1) facilitate the ability to interpret correctly an emotion in expressive dance and (H2) increase the perceived sociality among dancers.

Method

Participants

We drew on two separate sources for our participant pool. The 101 participants were either visitors to the public science museum, the Center for Science and Industry (COSI, $n = 61$) in Columbus, Ohio, or second-year music majors recruited from The Ohio State University's School of Music ($n = 40$), who received course credit for participation. At COSI, research assistants stationed outside an exhibit asked entering visitors if they would be interested in participating in a short study. Our decision to recruit from COSI in addition to the OSU participant pool was motivated by the desire to increase the diversity of the participants.

Materials

A recording session was conducted with four female members of the SYREN Modern Dance company, a professional group of dancers based in New York City. The dancers wore dark clothing and were video recorded against a neutral background. At the beginning of the session, we instructed the dancers to improvise choreography to express one of three specific emotions. The dancers were unaware of which emotion they would be expressing until approximately a minute before each of the recordings began, when the experimenters held up a sign with the name of the emotion. Dancers performed as a group using modern dance style and were instructed to maintain neutral facial expressions.

We recorded the dances for each of the three emotions six times, with each recording lasting approximately 60 s. First, dancers improvised three times without music. We recorded each improvisation without music first in order to avoid the possibility that experience with the music might affect the silent improvisation for the same emotion. For example, we first recorded three 60 s videos of the expression of melancholy without music. The dancers then listened to the musical excerpt one time. Then, we recorded three videos of the expression of melancholy with the accompanying melancholic music (Fauré, 1878/2015, track 8, 00:00-00:52). We repeated this process for the emotion of grief (Arnold & Price, 2012, track 18, 00:42-01:32) and fear (Elfman, 1992, track 5, 00:00-00:46). After all the stimuli had been recorded, one experimenter conducted an informal interview with the four SYREN dancers in a group setting in order to understand how the dancers interacted with each other and how they communicated the three emotions.

We edited the dance videos to be approximately 15 s in duration (Fauré, 1878/2015, track 8, 00:00-00:13; Arnold & Price, 2012, track 18, 01:11-01:26; Elfman, 1992, track 5, 00:09-00:25). The shorter videos contained the section of music that corresponded to previously validated excerpts that expressed the intended emotions (Eerola & Vuoskoski, 2011; Warrenburg, 2020c). The silent dance videos contained the first 15 s of dance from each video.

Procedure

Each participant viewed nine videos from the 18 recorded videos (nine silent dance videos, nine music and dance videos), selected by the randomizer function in Qualtrics. Participants therefore saw different collections of videos, some that were unimodal (dance-only) and some that were multimodal (dance-music). The participants answered an online series of six questions assessing the perception of emotional expression and sociality in the dances after each video. We also collected basic demographic information, namely age, gender, years of musical training, years of dance training, race/ethnicity, first language, and zip code.

To test the hypothesis that expressions of grief would be more accurately identified than expressions of melancholy, as well as to explore the relative interpretability of fearful expressions, viewers were asked, “What emotion do you think these dancers are expressing?” Participants selected one response from the following three options: fear, grief, or melancholy. This three-alternative forced choice (3-AFC) task mirrored the methodology in Warrenburg (2019, 2020c) for distinguishing perceived emotions in music samples. After answering the 3-AFC question, participants were asked to answer, “How intense was this emotion?” on a sliding scale from 0 (*not intense at all*) to 100 (*extremely intense*). We elected to use the word *intense* instead of the typical research term *physiological arousal* to aid in interpretability for our participants.

The aim of Hypothesis 2 was to determine whether viewers would perceive and experience more sociality in dances expressing grief than in dances expressing melancholy. We defined sociality in two ways. First, participants were asked, “How connected do you think the dancers feel to each other?” and “How connected do you feel with the dancers?” Responses were provided on a continuous sliding scale from 0 (*not at all connected*) to 100 (*extremely connected*). Second, we asked participants to complete the Inclusion of Other in the Self (IOS) scale (Aron, Aron, & Smollan, 1992; see Figure 1). The IOS scale, used primarily in the social science literature, measures social connectedness (e.g., Weinstein, Launay, Pearce, Dunbar, & Stewart 2016).¹ Here, participants responded to the prompt, “Please select the picture that best describes the relationship among the four dancers.” Finally, we measured experienced sociality through the prompt, “Please select the picture that best describes your current relationship with the video.”

Results

Overall Accuracy of Emotion Perception

The first hypothesis addressed whether observers were more accurate in their perception of grieving expressions than in their perception of melancholic expressions. Of a possible 909 responses, 102 responses contained blank values for the questions regarding which emotion the participants believed the dance was expressing and that emotion’s intensity. Across the remaining 807 responses to the dance videos (both modalities), the accuracy of identifying dances expressing melancholy was 65.4%, the accuracy of identifying dances expressing grief was 66.8%, and the accuracy of identifying dances expressing fear was 69.2% (Table 1). For each of the three emotion conditions, a binomial test was conducted to determine whether observers selected the correct emotion more often than chance (33.3%).

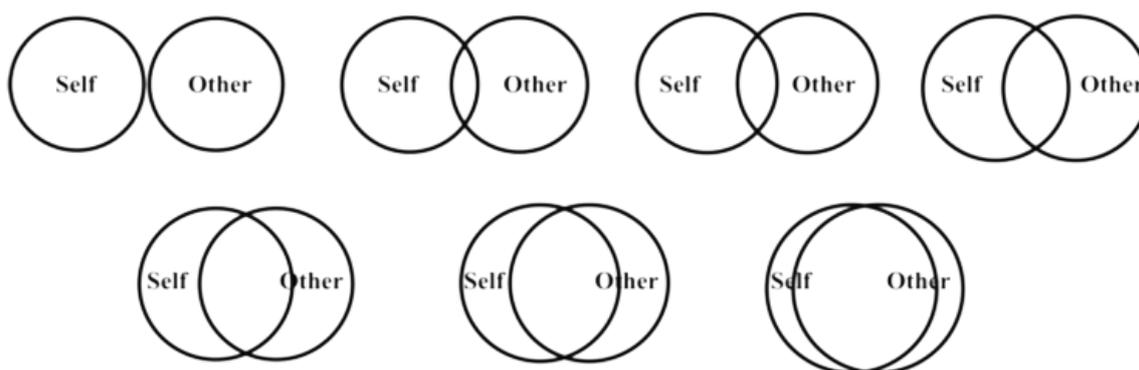


Figure 1. The Inclusion of Other in the Self (IOS) scale, a single-item pictorial measure of social connectedness. Reproduced from Aron, A., Aron, E. N., & Smollan, D. (1992). Inclusion of Other in the Self Scale and the structure of interpersonal closeness. *Journal of Personality and Social Psychology*, 63(4), 596–612. Reprinted with permission of the American Psychology Association as publisher.

Table 1. Results of Overall Emotion Perception Accuracy in Study 1 for Dances Expressing Melancholy, Grief, and Fear in Both Unimodal and Multimodal Conditions Over 807 Trials.

Overall Accuracy		
Melancholy	65.4%	(174 of 266 trials)
Grief	66.8%	(179 of 268 trials)
Fear	69.2%	(189 of 273 trials)

Observers correctly identified dances expressing melancholy more often than chance, successful trials = 174, total trials = 266, $p < .01$, 95% CI [.597, .711]. In the case of dances of melancholy, Cohen's g —the difference between the two percentages—is .321 (Cohen, 1988; Rosnow & Rosenthal, 2003). Any Cohen's g larger than .250 is considered a large effect size (Cohen, 1988). Similarly, observers correctly identified dances expressing grief more often than chance, successful trials = 179, total trials = 268, $p < .01$, 95% CI [.612, .724], with a similarly large effect size (Cohen's $g = .335$). Finally, observers also correctly identified dances expressing fear more often than chance, successful trials = 189, total trials = 273, $p < .01$, 95% CI [.638, .747], again with a large effect size (Cohen's $g = .359$).

We conducted a χ^2 test to compare the distributions of correct and incorrect emotion identification responses across the three emotion conditions (melancholy, grief, and fear). People did not differ in accuracy in the three emotion conditions, $\chi^2 = .915$, $df = 2$, $p = .633$. The results therefore do not support Hypothesis 1, which was that people would identify emotions accompanied by overt displays with more accuracy than emotions accompanied by covert displays.

Accuracy of Emotion Perception in Unimodal and Multimodal Settings

Overall, participants correctly identified the expressed emotion with 69.6% accuracy in the multimodal (dancing to music) condition and 64.8% accuracy in the unimodal (dancing in silence) condition (Table 2). The results of a Fisher's exact test were not consistent with the idea that people differed in accuracy between uni- and multimodal conditions, odds ratio = .805, $p = .155$. Follow up tests for each emotional expression revealed that, in the melancholy condition, people did not differ in accuracy in the multimodal condition (63.0%) or the unimodal condition (67.9%), odds ratio = 1.246, $p = .440$. People were more accurate, however, in identifying dances expressing grief in the unimodal condition (73.3%) than in the multimodal condition (60.2%), odds ratio = 1.822, $p = .027$. Finally, people were more accurate in identifying dances expressing fear in the multimodal condition (85.3%) than in the unimodal condition (53.3%), odds ratio = .197, $p < .01$.

Perception of Sociality in Dance Videos

Hypothesis 2 indicated that observers would perceive more sociality in dance videos expressing grief than in videos expressing melancholy. We used multiple linear regression to determine whether certain a priori features (including emotion type and modality) predicted the perceived connection among dancers. The variables used to predict perceived connection among dancers were (a) modality (unimodal vs. multimodal), (b) emotion type (melancholy, grief, fear), (c) intensity

Table 2. Results of Emotion Perception Accuracy for Unimodal (Dancing in Silence) Conditions and Multimodal (Dancing to Music) Conditions Over 807 Trials.

	Unimodal Accuracy		Multimodal Accuracy	
Overall	64.8%	(261 of 403 trials)	69.6%	(281 of 404 trials)
Melancholy	67.9%	(89 of 131 trials)	63.0%	(85 of 135 trials)
Grief	73.3% *	(99 of 135 trials)	60.2% *	(80 of 133 trials)
Fear	53.3% *	(73 of 137 trials)	85.3% *	(116 of 136 trials)

Note. The asterisk (*) indicates when the differences in accuracy between the unimodal and multimodal conditions were statistically significant.

(0—*not at all intense* to 100—*extremely intense*), (d) years of music training, and (e) years of dance training. We investigated modality and emotion types because they are the variables central to the study hypotheses; emotion type was one-hot encoded. Intensity and years of music and dance training were included in the regression analysis to act as statistical controls: Their inclusion in the model allows us to examine the effects of the main variables (modality and emotion type) independent of these features. Such a process helped minimize the possibility of spurious or epiphenomenal effects in the model.

Trials where the participants left some answers blank were not included in the analysis. Furthermore, only trials where the participants correctly identified the emotion expressed by the dancers were included in the analysis (515 trials), a decision that increased power and helped the main effects remain clear.² Some assumptions of linear regression were met, while others were not. The data did not suffer from multicollinearity (all VIF, other than the one-hot encoded emotion types, were < 5) and met the assumptions of homoscedasticity, Breusch-Pagan test: Lagrange multiplier statistic, $LM = 6.005$, $p = .539$. A Jarque-Bera test indicated that the data were not normally distributed, but a Q-Q plot suggested that the deviations from normality were relatively small, $JB = 29.526$, $p < .01$, skew = $-.523$, kurtosis = 3.532 . However, the errors of the model were not independent, Durbin-Watson test: $d = 1.803$, $p = .02$.

The regression analysis, summarized in Table 3, suggested that, when controlling for perceived emotional intensity and years of music and dance training, both fear and grief conditions resulted in higher ratings of perceived sociality among the dancers than melancholy conditions, as predicted by Hypothesis 2. In this regression analysis, perceived sociality was operationalized with the question, “How connected do you think the dancers feel to each other?”

The regression analysis results are consistent with the idea that videos with higher ratings of emotional intensity result in ratings of more sociality among the dancers. Participants with more years of music training perceived more sociality among the dancers, though the number of years of dance training did not affect the perceived sociality among dancers. The complete regression model resulted in an adjusted R^2 of .42, meaning that the variables (emotion type, emotional intensity, years of music training) explained 42% of the variance in the sociality scores.

A second regression model was performed using an alternative operationalization of sociality. In this second model, the dependent variable was the IOS scale (Aron et al., 1992),

which we discerned by asking participants to “Please select the picture that best describes the relationship among the four dancers” (see Figure 1). Once again, only data where the participants correctly identified the emotional expression were included in the model. The data did not suffer from multicollinearity (all VIF other than the one-hot encoded emotion types were < 5) and the errors of the model were independent, $d = 1.830$, $p = .05$. Although the Jarque-Bera test indicated that the data were not normally distributed, a Q-Q plot suggested that the deviations from normality were relatively small, $JB = 11.753$, $p < .01$, skew = $-.368$, kurtosis = 2.928 . The data did not meet the assumptions of homoscedasticity, Breusch-Pagan test: $LM = 16.841$, $p = .018$.

The five predictors were the same as in the first model: modality, emotion type, intensity of perceived emotion, years of music training, and years of dance training. For the most part, the results replicated those of the first regression: (a) videos where dancers were expressing grief or fear resulted in more perceived sociality among the dancers than did videos expressing melancholy, (b) higher scores of perceived emotional intensity led to more perceived sociality, (c) no effect of modality (dancing in silence versus dancing to music) was evident, and (d) dance training had no effect. The only finding that differed from the first model was that, in this second regression model, the effect of music training was not significant. This second regression model resulted in an adjusted R^2 of $.35$. In relation to Hypothesis 2, the results of the first and second regression models converge.

Table 3. Results of Linear Regressions for Perceived Sociality Among Dancers.

(a) Predicting Scores of Connection Among Dancers				
	<i>Estimate</i>	<i>Std. Error</i>	<i>t</i>	<i>p</i>
(Intercept)	19.637	2.110	9.307	$< .01$
Fear	12.311	1.644	7.488	$< .01$
Grief	13.460	1.691	7.958	$< .01$
Melancholy	-6.135	1.441	-4.256	$< .01$
Intensity	.494	.041	11.898	$< .01$
Years of Music Training	.530	.176	3.011	$< .01$
(b) Predicting Scores of the Inclusion of Other in the Self Among Dancers				
	<i>Estimate</i>	<i>Std. Error</i>	<i>t</i>	<i>p</i>
(Intercept)	2.001	.157	12.730	$< .01$
Fear	1.069	.122	8.723	$< .01$
Grief	1.152	.126	9.139	$< .01$
Melancholy	-.219	.107	-2.041	.04
Intensity	.030	.003	9.645	$< .01$

Note. Predictors were modality (unimodal vs. multimodal), emotion type (one-hot encoded), emotional intensity (0–100 scale), years of music training, and years of dance training. (a) Predicting scores of perceived connection among the dancers (0–100 scale), (b) Predicting IOS scores among the dancers (1–7 scale).

In order to test the difference in sociality perceptions between the dances expressing melancholy and grief, a post hoc logistic regression was conducted without the data related to fear expressions. The model predicted whether the dance videos were expressing melancholy or grief from the following predictors: modality (unimodal or multimodal), emotional intensity (0–100 scale), scores of perceived connection among the dancers (1–100 scale), scores of experienced connection between the self and the dancers (1–100 scale), self–other IOS (1–7 scale), dancer–dancer IOS (1–7 scale), years of music training, years of dance training, and emotion identification (correct vs. incorrect). The assumptions of logistic regression were met, as all continuous predictors and the logit of the outcome variable were linearly related. No multicollinearity was detected (all predictors had a VIF < 5).

The post hoc logistic regression analysis, summarized in Table 4, resulted in an accuracy of 70.4% and an AUC of .774. A confusion matrix of the predicted and observed values contained 174 correct melancholy classifications, 180 correct grief classifications, 78 false grief classifications (the dance expression was melancholy, but the model predicted grief), and 71 false melancholy classifications (the dance expression was grief, but the model predicted melancholy). The logistic regression model provides supporting evidence for the claim that slightly higher ratings of emotional intensity and higher scores of perceived sociality among dancers are more likely to be associated with videos where the dancers were expressing grief than with videos where the dancers were expressing melancholy. This sociality-related finding is consistent across two operationalizations of sociality: ratings of connection among the dancers and ratings of the dancer–dancer IOS. Therefore, the results of the logistic regression are consistent with Hypothesis 2. There was no effect of experienced sociality between the participants and dancers, operationalized in two ways (ratings of connection of self to dancers, ratings of self–video IOS). Modality, years of music training, years of dance training, and correct or incorrect emotion identification also were nonsignificant in the logistic regression model.

Discussion, Study 1

Emotional Accuracy

The first aim of Study 1 was to investigate whether observers would be more accurate in identifying dances expressing grief—which were conjectured to contain overt emotional displays

Table 4. Results of Post Hoc Logistic Regression Predicting Dances Expressing Melancholy (Coded as 0) versus Dances Expressing Grief (Coded as 1).

	Estimate	Std. Error	z	p
(Intercept)	-2.807	.384	-7.313	< .01
Intensity	.014	.006	2.494	.01
Perceived connection among dancers	.022	.006	3.520	< .01
IOS between dancers	.243	.084	2.901	< .01

—than dances expressing melancholy—which were conjectured to contain covert emotional displays. The results of Study 1 were not consistent with this hypothesis: There was no effect of grief versus melancholy in the accuracy of emotion perception.

The fact that observers did not differ in their accuracy between identifying dances expressing grief than dances expressing melancholy differs from Huron's (2015, 2016) theory that grief may function as an ethological signal and melancholy may function as an ethological cue. Huron proposed that because grief oftentimes is accompanied by overt displays and melancholy is often accompanied by covert displays, observers should be able to discern expressions of grief with greater accuracy than expressions of melancholy. An important aspect of the current study, however, is that we only examined melancholic and grieving expressions in aesthetic conditions. It is possible that, in aesthetic conditions such as dance, covert displays of an emotion like melancholy are exaggerated in order to communicate more directly with the observers. During performances, dancers may wish to alert the audience to emotions of their characters and therefore use overt expressions and behaviors to express all emotional states, regardless of how these states are expressed in everyday life. Additional research is needed to determine whether the similar accuracy in identifying melancholy and grief is replicated in nonaesthetic contexts.

Moreover, when designing the study, we expected that dances expressing fear would sometimes be accompanied by overt cues (related to high physiological arousal) and other times would be accompanied by covert cues (related to low physiological arousal). The intensity ratings of fear conditions ($M = 57.271$, $SD = 24.811$) were skewed toward higher ratings. Mean fear intensity fell between mean melancholy intensity ($M = 45.414$, $SD = 27.431$) and mean grief intensity ($M = 60.366$, $SD = 22.979$). The fact that fear was expressed in dances with relatively higher intensity could suggest that dancers use more overt displays to represent emotional states in order to aid in communication with audiences, as discussed above.

The similar accuracies also could be related to the 3-AFC paradigm used in Study 1. That is, the ability to differentiate grieving expressions from melancholic expressions might depend on the corresponding physiological arousal (intensity) of these two subjective feeling states: Participants could observe cues of low physiological arousal—which typically result in relatively covert displays—in the videos expressing melancholy and observe cues of high physiological arousal—which typically result in comparatively overt displays—in the videos expressing grief. Thus, the results of Study 1 could be interpreted in two ways: They could indicate that participants are sensitive to (a) cues of high and low physiological arousal or (b) highly overt and highly covert emotional displays. Future studies should utilize numerous negative emotions typically associated with high physiological arousal equally with those typically associated with low physiological arousal. Additionally, future research should directly measure the correlation between continuous scales of intensity and the relative amount of overt emotional displays. Finally, new research should replicate the current study and include more than three negative emotion choices (melancholy, grief, fear), include positive emotion choices, or use a free-response format.

The test comparing accuracy of emotion identification between unimodal (dancing in silence) and multimodal (dancing to music) conditions did not reveal a difference in accuracy, a result that differs from previous findings showing that dance–music conditions typically result in more accurate emotion identification than dance–only conditions (Burger et al., 2013). In that study by Burger and colleagues, the researchers found that dance–only conditions expressing negative emotions were sometimes mistaken as expressing positive emotions. The researchers theorized that the erroneous detection of positive emotions could be due to the fact

that dance is usually an enjoyable experience. In our study design, we did not examine any positively valenced emotions and observers were not given options to select a positive emotion. Moreover, the lack of accuracy differences between uni- and multimodal conditions in the present study could suggest that, when presented with a list of only negatively valenced emotions, observers find it easier to identify the expressed emotion because they need to discern differences only in comparatively overt or covert displays.

It is possible that the lack in difference of accuracy between the uni- and multimodal conditions in the current study is due to cue redundancy in dance and music. Namely, a similar number (or type) of emotional expressions may be present in both dance and music so that an observer gains no additional information from bimodal expressions (dance–music), as compared to a unimodal expression (dance–only, music–only). Recent research examined 18 music structural features in melancholic and grieving musical samples, including the melancholic and grieving excerpts used in the present study (Warrenburg, 2020b). The results of that music study suggest that melancholic music tends to be quiet, low in register, and contain narrow pitch intervals, while grieving music tends to contain sustained tones, gliding pitches, and harsh timbres. It is possible, then, that dance-related expressions of melancholy mirror these music compositional cues; for example, they may contain small movements and only use a confined amount of space. Expressions of grief in dance may also be similar to their musical parallels and employ large, sweeping movements and utilize a wider area of space.

It is enlightening to compare the emotion identification accuracy of dance–only expressions, music–only expressions, and dance–music expressions of grief and melancholy. Warrenburg (2020c) previously conducted a study of emotion perception in musical passages that express melancholy and grief, including the musical excerpts used in the present study. The music study used a different methodology than the current dance study: The music study included both positively and negatively valenced musical excerpts and a 5-AFC question format (grief, melancholy, happiness, tenderness, none). Despite these methodological differences, we analyzed the emotion identification responses in the music study for the melancholic excerpt by Fauré (1878/2015, track 8) and the grieving excerpt by Arnold & Price (2012, track 18). In this analysis, the positively valenced emotion choices were ignored—only the responses of melancholy and grief were compared. The music–only condition of melancholic aesthetic expressions resulted in an accuracy of 70%, as opposed to the dance–only condition (68% accuracy) and the dance–music condition (63% accuracy). Similarly, the music–only condition of grieving aesthetic expressions resulted in an accuracy of 84%, compared to the dance–only condition (73% accuracy) and the dance–music condition (60% accuracy). Future work needs to directly test whether participants observe similar or different cues in dance expressions and musical expressions. As one example, researchers could mismatch music and dance conditions—in one condition, the music would express grief while the dance would express melancholy. Results from this type of study could assess the relative importance of music-related and dance-related cues.

Sociality

The second goal of Study 1 was to test whether observers would perceive more sociality in videos expressing emotions with overt displays (grief) than in videos expressing emotions with covert displays (melancholy). We based this hypothesis on the theory that although melancholy may have evolved (in part) to enable self-reflection, grief may have evolved (in part) to signal

that the experiencer needs assistance from other people (Huron, 2015, 2016). The results of Study 1 support the idea that when dancers express emotions that typically are accompanied by overt displays, such as grief, observers perceive the dancers as being more socially connected than when dancers express an emotion like melancholy, which usually is accompanied by covert displays.

Thus, we might expect that, in aesthetic conditions such as dance and music, the combination of grieving sonic and movement cues in expressions of grief (and fear) may result in “repercussive” feelings of compassion or prosociality on the part of the observer or listener (Huron & Vuoskoski, 2020). These feelings of compassion or prosociality theoretically should be diminished in aesthetic expressions of melancholy. Warrenburg (in press) found in a study of free classifications of experienced emotions to grieving and melancholic music that respondents reported more feelings of crying and death/loss in music expressing grief, whereas instances of reflection were more frequent with music expressing melancholy. She theorized that reflection, a nonsocial behavior, may correspond to the theorized function of melancholy, which is to ruminate or self-reflect on a failed goal or poor experience. On the other hand, crying and death/loss are social behaviors that align with the theorized function of grief, which is to solicit assistance or comfort from another person (Huron, 2015, 2016; Urban, 1988; Vingerhoets & Cornelius, 2012). The findings of Warrenburg (2020c) and the results of the current study are consistent with the idea that in aesthetic conditions—music-only, dance-only, and dance-music—participants perceive more sociality in emotions often accompanied by overt displays, such as grief, than in emotions often accompanied by covert displays, such as melancholy. The post hoc logistic regression presented in Table 4 was consistent with the idea that people perceive more sociality among the dancers in videos that expressed grief compared to videos where the dancers expressed melancholy.

Earlier, we noted the possibility that emotional expressions may be heightened in aesthetic conditions (dance, music) as compared to nonaesthetic conditions (everyday life). If this speculation is correct, it could help explain our finding that fear expressions, in addition to grief expressions, also resulted in higher perceived sociality among the dancers than did melancholic expressions. Although fear can be accompanied by covert or overt displays in nonaesthetic conditions, it could be that, in aesthetic contexts, it is more desirable for performers to utilize overt expressions, including specific dance movements and social interactions with other dancers. These overt characteristics might better enable audience members to discern accurately the emotional state of their characters. We tested this conjecture directly in Study 2, where social interactions were operationalized as physical touch among dancers.

STUDY 2: SOCIALITY AMONG DANCERS

Study 1 addressed audience perception of sociality by testing whether participants would perceive more sociality among dancers expressing grief than among dancers expressing melancholy. Study 2 characterized sociality among the dancers in a different way, that is, with the prediction that dancers would exhibit more social behavior in emotions typically associated with overt displays, such as grief, compared to emotions typically associated with covert displays, such as melancholy (Hypothesis 3). In this second study, social behaviors were operationalized as the proportion of time in each improvisation that the dancers spent in physical contact with one another.

Method

The iPhone stopwatch application was used to record the length of time in seconds in each of the 60 s videos during which two or more dancers were in physical contact. Two independent coders who were not aware of the hypotheses performed this analysis. The coders watched each video silently, regardless of whether there was musical accompaniment, and were unaware of which videos had been recorded with music and which had not. Coders watched each video three times, and each coder watched the videos in a unique random order. On the first viewing, coders were asked to simply watch the video and observe patterns of touch without recording anything. On the second and third viewings, coders recorded the amount of time the dancers spent in physical contact by starting the stopwatch each time any two dancers came into contact and stopping it when all dancers ceased contact; these two recorded times were then averaged. This value was divided by the total time of each video, resulting in a proportion of time spent in physical contact.

Results

Table 5 lists the proportion of time spent in physical contact among two or more dancers in each of the 18 videos for each coder, as well as the average proportion of the two coders. Each proportion represents the amount of time of physical contact (touching) among at least two dancers, compared to the amount of time with no physical contact among any of the four dancers. Although the two coders' times did not always agree precisely, their recorded times were strongly correlated at $r = .99$.

Discussion, Study 2

The second goal of the paper was to examine whether differences could be identified in the sociality of dancers in performances expressing melancholy, grief, and fear. In Study 1, we tested observers' perception of sociality among dancers (Hypothesis 2); in Study 2, we tested the physical connection of the dancers (Hypothesis 3). The results of Study 1 were consistent with the idea that observers perceive relatively more sociality among performers in dances expressing grief and fear—which often are accompanied by overt emotional displays—than in dances expressing melancholy and its usually covert emotional displays. The results of Study 2 converge with the results of Study 1: When operationalizing social behavior as the amount of time that dancers spent in physical contact during the performance, we found that, on average, dancers spent a higher proportion of time in physical contact when they expressed grief and fear as compared to when they expressed melancholy. Furthermore, in both the grief and fear conditions, dancers spent more than 50% of the time in physical contact with each other (grief percent of touching $M = 65%$; fear percent of touching $M = 59%$). In the melancholic condition, dancers spent only 30% of the time in physical contact. As demonstrated in Figure 2, this order of grief, fear, melancholy is preserved not only in the mean proportions of time in physical contact, but also in the range of times spent in physical contact for each set of six videos per emotion condition. Due to the small sample size of videos, we did not run statistical analyses comparing these conditions. To establish the possible significance of a difference in physical contact between dances expressing grief, fear, and melancholy, we recommend replicating this study with a larger sample of videos, ideally with more than one group of dancers.

Table 5. Proportion of Time Spent in Physical Contact, Viewed on Video.

Condition	Video	Proportion of time spent in contact		
		Coder 1	Coder 2	Average
Melancholy, dance-only	1	.02	.08	.05
	2	.45	.45	.45
	3	.32	.31	.32
Melancholy, dance-music	1	.00	.00	.00
	2	.33	.29	.31
	3	.66	.70	.68
Grief, dance-only	1	.43	.38	.41
	2	.67	.70	.69
	3	1.00	1.00	1.00
Grief, dance-music	1	.45	.45	.45
	2	.48	.41	.45
	3	.90	.88	.89
Fear, dance-only	1	.21	.22	.22
	2	.65	.65	.65
	3	.90	.92	.91
Fear, dance-music	1	.48	.48	.48
	2	.35	.34	.35
	3	.91	.91	.91

Note. Each proportion represents the amount of time that some level of physical touch took place between at least two dancers as compared to the time in which no physical contact occurred among any of the four dancers.

The results do not indicate a consistent trend of time spent in physical contact in dance-only versus dance-music conditions across emotion types. Furthermore, because all dance-music conditions were recorded after dance-only conditions, we cannot eliminate the possibility of order effects. Future research could expand on the current results through further application of the touch timing method presented here. The study could also be replicated using dancers without formal training, as opposed to the professional SYREN dancers in the current study. However, as groups of people unfamiliar with each other may be uncomfortable making physical contact in a dance improvisation, a study could explore the level of contact among amateur dancers, that is, with pairs or groups of people who are in relationships where physical touch is common, such as couples or families.

The differences in the amount of physical contact among dancers may have acted as information to help participants distinguish between dances expressing grief/fear versus dances expressing melancholy. That is, in response to a dance video with a high amount of physical touch, participants may have used this characteristic (likely unconsciously) to help make their decision to select grief (or fear) as opposed to melancholy. Alternately, in a dance video with a low amount of physical contact, participants may have used this display to aid in their decision to select melancholy as opposed to grief/fear. Because there was little difference in the amount

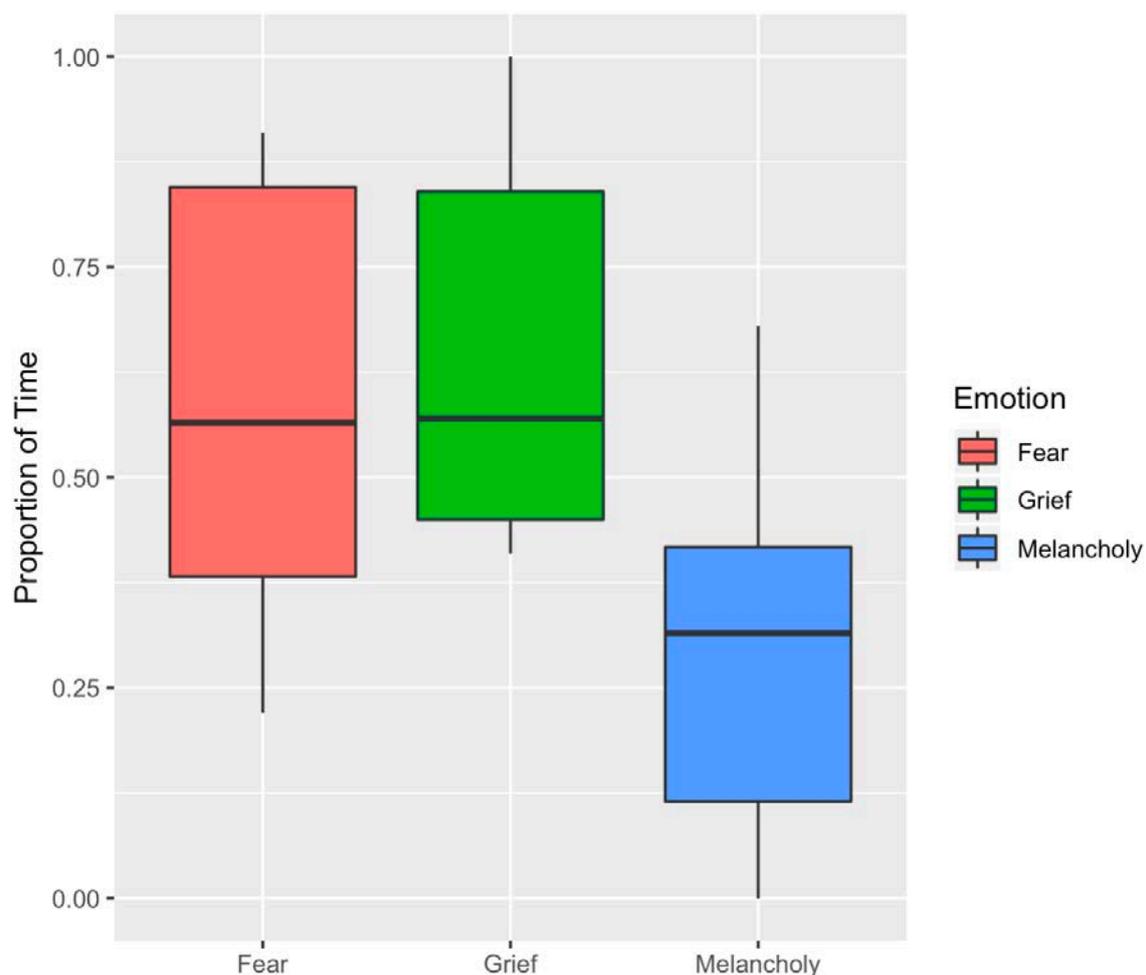


Figure 2. Box and whiskers plot of the proportions of time spent in physical contact among the dancers in each emotion condition (dance-only and dance-music combined). Times used in this graph are the average of both coders (see “Average” column of Table 5).

of physical contact in grief and fear conditions, the amount of physical touch among dancers probably was not a consequential factor in differentiating these two expressions. Instead, other types of bodily expressions likely were used to help participants distinguish fear and grief.

The idea that physical touch can help differentiate expressions of melancholy and grief, but not help differentiate expressions of grief and fear, is in line with the emotion literature discussed in the Introduction. Recall that both melancholy and grief are considered to be subtypes of sadness and can be experienced in response to the same event, such as the death of a marital partner. Fear, on the other hand, is elicited in different types of circumstances than melancholy and grief. Although the function of melancholy may be to self-reflect on a failure or minor loss, such as being rejected from a job application, and the function of grief may be to seek compassionate behaviors after a loss, Ekman (1992) hypothesized that fear may surface when a person expects to fail at a goal or task or anticipates suffering a loss of consequence. In the way that sadness may consist of multiple subtypes (e.g., grief, melancholy), fear itself may be considered to be a broad emotional category that can be broken into subtypes (e.g., anxiety, panic; Ji & Maren, 2007; Mobbs et al.,

2007). Given this research, it may be more likely for a person's emotional response to the death of their marital partner to alternate regularly between periods of melancholy and grief, and less likely to regularly alternate between periods of melancholy and fear (or periods of grief and fear). Of course, personal situations, contexts and environments, personalities, and physical responses vary greatly among people and this trend will not explain many peoples' responses to a tragic event.

In response to the 3-AFC task of selecting the terms melancholy, grief, and fear to best describe dance expressions, one approach taken by participants may have been first to decide between general sadness (melancholy or grief) and fear. Subsequently, if they perceived sadness in the videos, they could then have used additional factors, including physical touch, to determine whether the subtype of sadness was melancholy or grief (see Warrenburg, 2020b, for more details about distinguishing characteristics of melancholy and grief). Another approach taken by participants could have been to first use cues of physical touch to differentiate emotions typically associated with low physiological arousal (such as melancholy) from emotions typically associated with high physiological arousal (such as grief and sometimes fear). After this distinction, the participant then may have examined emotional displays to distinguish expressions of fear and grief.

GENERAL DISCUSSION

Two experiments tested the theory that the difference between overt and covert emotional displays is pertinent to emotional expressions in dance. One goal of the present study was to test whether people perceive dances expressing emotions such as grief—which tend to be accompanied by overt displays—with higher accuracy than dances expressing emotions like melancholy, which tend to be accompanied by covert displays. The results of the first study were not consistent with this idea: Participants did not differ significantly in accuracy among conditions of melancholy, grief, and fear. It is possible that the overt/covert distinction, usually discussed in nonaesthetic conditions (everyday life), does not carry over to aesthetic conditions (dance, music). Because one of the major goals of art, including dance and music, is to communicate with audiences, emotional displays may be heightened in expressions of melancholy, grief, and fear.

The second goal of the study was to examine whether dances expressing grief contained more social interactions than dances expressing melancholy. The results of the second study are in line with this conjecture. First, we found that observer participants perceived more connection among the dancers in dances expressing grief and fear than in dances expressing melancholy. Second, we found that dancers were in physical contact more often, as determined by two independent timing coders, when expressing grief and fear than when expressing melancholy. The findings of both studies have implications for the role of sociality in aesthetic conditions.

Sociality in Aesthetic Conditions

Dancing, music making, and music listening are all inherently social activities that can unify groups of people, contribute to emotional contagion, and give people a sense of identity (Huron, 2005). For example, dance and music are essential components in many kinds of religious ceremonies and war dances. Behaviors such as synchronization to music and coordination through dance may promote social bonding and prosocial actions, possibly leading to feelings

of pleasure (Semin & Caccioppo, 2008). Huron (2005) theorized that the emotions arising from listening to, performing, and dancing to music are contagious. Because emotional contagion can lead to social congruence and cooperation, Huron suggested that the effectiveness of a group's actions may improve when dancing to music. Expressing emotions in aesthetic conditions, then, may be beneficial for the affective state of each group member.

In addition to occurring within the self, emotions may occur on different social levels, including on an interpersonal level, an intergroup level, and a sociocultural level (Haidt, 2012; Keltner & Haidt, 1999). Although the natural human state may be to focus on the needs and goals of the individual (for survival purposes), at times individual competition is not as important as group cooperation (Darwin, 1872). Certain emotions, such as awe or transcendence, can be associated with group levels of focus, which in turn can help group members define group-related roles and help them assume cultural identities (Haidt, 2012). Research has shown that people who are better able to understand others' emotions tend to be more imaginative, exhibit more forgiveness, and act more prosocially (Strayer & Roberts, 1989; Wieseke, Geigenmüller, & Kraus, 2012). Additionally, some negative emotions, such as grief, can also be experienced interpersonally, such as when partners experience the loss of their child. These shared emotions may lead to heightened displays of sociality among the group experiencers.

In order to learn about the dancers' experiences of sociality in the melancholic, grieving, and fearful conditions, we conducted a group interview with the SYREN dancers once they had finished improvising to all of the emotional prompts. In this interview, we aimed to capture the dancers' mental schemas of the target emotions and to gain insight into the dancers' experiences in expressing these three emotions. The comments from these interviews further support the idea that group dynamics were magnified during improvisations expressing grief and fear, as compared to improvisations expressing melancholy.

The dancers were asked to talk about their own definitions of melancholy, grief, and fear; which actions they used to express these three emotions; and if (and how) their experience differed when dancing with and without music. We did not inform the dancers of the hypotheses or the purpose of the experiment; however, the theme of sociality arose as the dancers addressed the types of actions they used to express each of the emotions.

Researcher (R): How did you choose the specific actions that communicated each of the emotions?

Dancer 1 (D1): *...sometimes I feel like, as a group, we definitely collectively decided we're going to do [the dance] this time together. In grief, one of the times, we were very much just like—*

Dancer 2 (D2): *—comforting.*

D1: *—getting through it together. So I think there were different lenses that each one took little bit that way.*

R: I remember what you're talking about, that time where you were all very integrated in the grief. Did you feel like you had that experience when doing the melancholy?

Dancer 3 (D3): *At times.*

D2: *I feel like grief and fear felt more natural to find that interaction.*

D3: *Right. I thought melancholy was a little—I don't want to say playful, but there were more moments of "Here I'm going to do something with this person and, real quick, I'm going to leave them and go into something with another person."*

D1: *I don't feel like we had that kind of group sense, where it was like we're all going to tackle this together—maybe that's because melancholy is something we kind of each go through on our own, and fear and grief we—*

Dancer 4 (D4): *—we should reach out more.*

D2: *There's definitely more support in fear and grief, I would—like, I would say, in day to day. So, I feel like our improv reflected that.*

In light of these statements, it is possible that the dancers interpreted emotions like grief and fear as emotional states that give rise to a collective experience among all dancers. For example, they seem to have interpreted fear as a shared emotion, so that all of the dancers portrayed fear: They all responded as a single group to an external aggressor, rather than having some dancers portraying aggressors and other dancers portraying fearful victims. Similarly, in dances expressing grief, the dancers seem to have interpreted the emotion as a shared grieving experience, where all dancers expressed grief in an interpersonal manner.

Emotional Displays Cannot Be Interpreted as Affective Feelings

As use of recording technology has expanded in the last century, and particularly with the advent of multiple video streaming sites, it has become possible to listen to music or to watch dances in nonsocial settings. The advent of headphones and portable electronic devices, such as laptops, tablet computers, CDs, and mobile phones, allow people to watch videos and listen to music outside of the home, as well. Today, much of the music listening in the West is done privately (Greasley & Lamont, 2011; Krause, North, & Hewitt, 2016). Accordingly, research into music and dance often examines emotional responses to these art forms within an individual setting. The studies presented here, as well as the interview with the SYREN dancers, suggest that displays and experiences of sociality are central to artistic emotional expressions.

Technologies such as motion capture, video recordings, and psychophysiology methods often have been used in academic research to learn how emotions are expressed and perceived in nonaesthetic conditions (Adolphs, 2017; Cordaro et al., 2020; Cowen & Keltner, 2017; Keltner, Sauter, Tracy, & Cowen, 2019). The results of the current study suggest that technology can also capture and communicate certain aspects of how artists express emotions in aesthetic conditions (also see Alaerts, Nackaerts, Meyns, Swinnen, & Wenderoth, 2011; Cowen, Fang, Sauter, & Keltner, 2020; Trevor, 2018; Vuoskoski, Thompson, Clarke, & Spence, 2020, for this type of work).

Recall, however, that a 1-to-1 correlation does not exist between emotional expressions or behaviors and underlying subjective feeling states (Barrett, 2017; Russell, 2003). Although technologies and physiological measures provide insight into a person's emotional expressions and behaviors, these displays cannot be interpreted as affective feeling states. As mentioned in the Introduction, without directly asking a person to label their subjective emotional state, and without understanding the situational context, the person's bodily interoceptive responses, and native language, it is impossible to conclusively determine the emotional state of another person. Given these considerations, future research on classifying emotional expressions could benefit from new approaches. Instead of classifying an emotional expression into a single category (using classification metrics), technologies could provide likelihoods that an expression fits under multiple dimensions (e.g., Bayesian approaches, convoluted neural networks).

Technology that analyzes expressions and behaviors should also be integrated with additional sources of information, including situational and contextual cues, as well as multimodal and continuous responses (e.g., bodily expressions, facial expressions, vocal signals). Drawing information from across multiple sources should aid in increased interpretability and ecological validity to the study of emotional expression in aesthetic and nonaesthetic contexts.

The distinction between overt and covert displays, as well as the relative sociality of these displays, is central to interpreting a person's emotional expressions or behaviors. Overt emotional displays will be conspicuous and possibly multimodal. Technologies will have a relatively easier time recognizing overt emotional expressions in people because of potential differences among facial, vocal, and/or bodily expressions. The baseline performance in classifying covert emotional expressions should be expected to be lower. For example, the physiological characteristics and expressions of people in melancholic and sleepy states overlap extensively, with some researchers even suggesting that sleepiness and melancholy can only be differentiated by invisible cognitive factors (Andrews & Thomson, 2009; Nesse, 1991). Emotions accompanied by covert displays may not contain any observable or distinctive facial, vocal, or behavioral expressions. Thus, a technological device may not be able to differentiate among covert emotional displays without additional information from the user. Baseline understandings of a person's emotional granularity, first language (and that language's emotional lexicon), verbal self-reported emotional feelings, personality, past history, situational location (alone or with others), time of day, and relative health are all important differentiators in the detection of covert (and overt) emotional displays.

CONCLUSIONS

The current study investigated how people perceived expressions of negatively valenced emotion in silent dances and dances with musical accompaniment. Four members of a professional dance company, SYREN Modern Dance, were recorded dancing with the intention of expressing melancholy, grief, or fear. In the first study, observer participants were asked to identify which emotion the dancers were expressing in each video using a 3-AFC paradigm. In addition, the participants were asked to rate how socially connected they believed the dancers to be throughout the dance. In the second study, two individuals who did not participate in the first study and were not informed of the intent of our study were asked to code the percentage of time the dancers were in physical contact in each video.

Hypothesis 1 predicted that observers would be more accurate when identifying dance expressions of grief than when identifying dance expressions of melancholy because feelings of grief are often accompanied by overt emotional displays and feelings of melancholy are often accompanied by covert emotional displays. Although participants were able to identify expressions of melancholy, grief, and fear more than chance, there was no difference in accuracy among these three emotion conditions.

Hypothesis 2 predicted that observers would perceive more sociality among dancers expressing grief than among dancers expressing melancholy. The results were consistent with this hypothesis: Controlling for perceived emotion intensity and years of music/dance training, dances expressing grief (and fear) resulted in higher observer ratings of social connection among the SYREN dancers than dances expressing melancholy.

Hypothesis 3 predicted that dancers would objectively exhibit more social behaviors while dancing to express grief than while dancing to express melancholy. Social behavior was defined as the amount of time the dancers spent in physical contact with each other. Once again, the results were consistent with this idea. Dancers behaved more socially while expressing grief (and fear) than while expressing melancholy. The results of the two studies are consistent with the idea that aesthetic expressions of grief and fear facilitate more social behaviors than aesthetic expressions of melancholy.

IMPLICATIONS FOR RESEARCH AND APPLICATION

The presented research provides insight into how negative emotions are expressed in dances with and without music, as well as how dance and music work together to facilitate perceptions of the performers' social connection. Future research focusing on the nature of emotional expressions in aesthetic conditions can build on our findings by examining not only the movements of dancers, but also on the movements of musicians and audience members.

The implications of using technology to understand expressions of emotion in aesthetic and nonaesthetic conditions extends beyond academia and into industry, as many companies specialize in detecting and evaluating consumers' emotions through technology present in cell phones, computers, and videos. Even though technologies and physiological measures certainly can provide users, researchers, and businesses with information about a person's emotional displays, the expressions captured by technology should not be interpreted as affective feeling states. However, by including information about overt and covert emotional displays, as well as social versus nonsocial emotional expressions, technology companies could expect improvements in model accuracy, sensitivity, and specificity, as well as their overall classification of emotional expressions. The ability of technology to aid in interpreting emotional displays in aesthetic (and nonaesthetic) contexts affects businesses of all sizes, as well as governmental systems like SPOT (Screening Passengers by Observation Techniques), which was designed to detect signs of deception or fear in airport passengers.

ENDNOTES

1. For further detail, see Cialdini, Brown, Lewis, Luce, & Neuberg (1997) and Hauser, Preston, & Stansfield (2014). Although an empathic person is able to distinguish between the self and the other during an empathic state, most people feel a "self-other overlap" (Aron et al., 1992) with others. This self-other overlap is thought to have evolved so that when an individual helps another person in need, it contributes to positive feelings in oneself.
2. That is, if noncorrect responses were included in the model, it is possible that each main effect could be split into separate trends: one trend for correct responses and a second trend for incorrect responses. If the direction of these two trends differed, the result could be a horizontal line with no direction. Separating trends due to correct and incorrect responses could have been handled through a mediation, moderation, or conditional process analysis had we had a larger number of participants and responses. Future research should replicate the findings of the present study with a larger number of participants.

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