The Role of Expertise in Perceiving Emotions Through Kinematics

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THE ROLE OF EXPERTISE IN PERCEIVING EMOTIONS THROUGH KINEMATICS

by

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Abstract

There has been much debate about how we perceive other people's minds. Some theories, such as Theory of Mind, are based on the presumption that the minds of others are closed and inaccessible, requiring some form of inferential processing and mentalizing to understand. On the other hand, Direct Social Perception says that information about the mental states of others is readily available to perceive and requires no internal processing to understand. Taking either theory into account, it remains an open question if expertise plays a role in social perception. This study aimed to identify if experience in portraying emotions through dance would affect recognition of emotional body movement. A group of 21 dancers and 23 non-dancers viewed 40 point-light displays of movement showing anger, fear, happiness, and sadness. Their accuracy and reaction time were recorded. It was hypothesized that dancers would have increased accuracy, as well as faster reaction times across emotions. A 4 × 2 ANOVA was used to analyze the results. Results rejected the hypothesis that dancers would have increased accuracy and reaction time, indicating no significant differences between the two groups. A significant main effect was found on the accuracy data for emotion type. Fear and happiness were the most accurately recognized emotions across groups.

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CHAPTER ONE: INTRODUCTION

Theories in Social Perception

To interact with one another, humans must attribute mental states to others in their environment. The minds of others have traditionally been assumed to be closed and inaccessible. To form an understanding of others' mental states, one must develop a Theory of Mind (TOM). TOM is the concept of attributing a wide range of mental states including intentions, beliefs, and desires to others with the goal of interpreting, explaining, and predicting their behavior (Premack & Woodruff, 1978). The ability is sometimes referred to as "mind reading" or "mentalizing" and is thought to develop in early childhood. The way we attribute mental states to others is split into two accounts, Theory Theory (TT) and Simulation Theory (ST). TT holds that individuals have a basic understanding of human behavior, a folk psychology view of other's minds and use this to make inferences about mental states. Folk psychology is the idea that we have a framework of concepts that include knowledge of social structures, roles, or knowledge about a person's history or personality that help form a basic understanding of everyday life. According to TT, this framework is used when mindreading (Spaulding, 2012). ST suggests that individuals base these attributions on their own mental states and experiences and denies the use of theories in understanding others. Instead, ST argues that we use our own minds to simulate the minds of others (Davies & Stone, 1995). Although the mechanisms through which mental states of others are attributed differ between TT and ST, the goal is the same. To function appropriately in social situations, one must mentalize the states of others to understand and formulate a response.

The presumption that the minds of others are hidden away and require inferential processing is challenged by the notion of Direct Social Perception (DSP), which posits that the mental states of others are directly perceivable. According to this view, information about the mental states of others is readily available to pick up and requires no inferential mediation (Gallagher, 2008; Wiltshire et al., 2015). Many mental states are perceivable by others because they are thought to manifest in bodily states. During social perception, viewers are provided with enough information about the mental state of others from bodily states that manifest during the social interaction. According to DSP, we see the mental state in the behavior. For example, if a person is crying you see that they are upset. There is no inference over what the behavior is telling us about the mental state, you simply see the mental state in the behavior. Those in support of DSP argue that mental states are perceived in the same immediacy as regular, everyday objects, such as a cup. When perceiving a cup, one does not infer from sense data that the object is a cup, one simply sees that it is a cup. Unlike other inferential theories, DSP denies that mental states are hidden and unobservable.

Direct Social Perception and Affordances

According to Gibson (1979), humans perceive to act and act to perceive. Gibson referred to this as the perception-action cycle. In this cycle, perception is based on opportunities for action, known as affordances. Affordances correspond to a relationship between the perceiver and the actions they can perform with objects or events in their environment. In Gibson's (1979) theory of direct perception, he proposes that information about affordances is specified in the form of invariant patterns in optic flow. In terms of individual action, such personal affordances can include perceiving the graspability of an object or the passability of a doorway (Warren & Whang, 1987). In terms of social interactions, interpersonal affordances can include reciprocal social actions such as those between a buyer and seller, or between predator and prey (Gibson, 1979). The idea is that there is optical information about interpersonal affordances that provide sufficient information to guide interaction without additional inferences needed.

Recently, Newen, Welpinghus, and Juckel (2015) argued that the perception of different emotions is distinguished by specific characteristics and patterns, and that emotional recognition is simply a process of pattern recognition. They argue that there is a typical behavior for some emotions, and that perceiving these emotions rely on using these expressive actions as signs in emotion recognition. Similarly, the James Lange theory of emotion states that emotional states have equivalent physiological responses, and to have an emotion one must experience certain bodily responses. Following this theory, to perceive another person's mental state would be a matter of recognizing their physiological response as a specific emotion. This idea that a person's bodily state can give insight about their mental state is supported by findings from Atkinson et al. (2004), who found that postures and gestures gave viewers sufficient information to correctly identify emotions using dynamic point-light displays. Emotions are not the only candidates suitable for DSP. An embodied cognition approach supports the view that intentions may be externalized and thus directly perceivable. Intentions are conceptually connected to action, and because of this we can directly perceive intentions (Spaulding, 2015).

Social Event Perception

Different types of limb motions such as walking, dancing, and running, along with the speed at which these movements are done, are easily identifiable in human vision. Johansson (1973) has shown that these movements can also be identified using abstract light patterns called point-light displays. This technique involves attaching small lights to the joints of actors and filming their movement in the dark so that just the point-light movement is captured. This technique ensures that only the kinematics are captured, and all other extra background information is not included in the display. Johansson (1973) found that walking movement was readily picked up by viewers when using these point-light displays, leading to further studies to test how much information can be identified using point-light displays. In a later study, Johansson (1976) found that viewers could differentiate between point-light displays showing non-biological movement by puppets and biological movement by human actors, even with similarities in spatial patterns. Johansson (1976) noted that the findings suggest that visual processing relies on approximations of movements rather than rigid mathematical procedures.

The idea that we use these visual approximations to understand movements is supported and built upon in numerous other studies. Runeson and Frykholm (1981, 1983) found that observers were able to accurately judge the weight of a box being lifted by point-light actors, as well as if the actor's intention was to deceive about the weight. This supports the principle of Kinematic Specification of Dynamics (KSD), which states the kinematic properties provide information to specify their causes. Kinematic properties are the motions, while dynamics refers to an explanation of the motion in terms of what causes it. The idea that kinematic patterns provide rich sources of information can be further supported in studies where the sex of a point-light walker was readily identifiable (Kozlowski & Cutting, 1977) as well as identity (Cutting & Kozlowski, 1977). Studies examining emotional perception using point-light displays found that observers could identify sadness, anger, and happiness from gait information alone (Montepare, Goldstein, & Clausen, 1987). A more recent study compared the same stimuli in both point-light and full-light display (Atkinson, Dittrich, Gemmell, & Young, 2004). In this study, ten actors were asked to portray five emotions (anger, disgust, fear, happiness, and sadness) at three levels of exaggeration. Two sets (one in full-light with faces covered, and one in point-light) of 150 portrayals of emotions were created, along with a corresponding static image captured at the peak expression of each emotional portrayal. Their findings confirmed that basic emotions are readily identifiable in point-light displays, as well as in full-light. It was also found that exaggeration of movements led to greater recognition accuracy, especially in the point-light condition, and that the videos produced higher emotional-intensity ratings than the static images. This finding suggests that emotional rating judgement relies more on movement than static information.

These papers suggest that not only is it important to use dynamic stimuli as opposed to static, but additionally that there is valuable information in bodily movement and point-light displays are useful in separating this movement from background noise. Ansuini, Cavallo, Bertone, & Becchio (2014) summarize past research which has shown that observers are able to use kinematic information to make judgements about movement patterns and intentions. Research has shown observers ability to judge the intention of observed reach to grasp movement as cooperative, competitive, or individual (Becchio, Cavallo, Begliomini, Sartori, Feltrin, & Castiello, 2012). These findings support the conceptual views of KSD as well as the empirical validity of using patch-light displays to study social knowing. The findings also provide support for the proposition that kinematic information is perceived and used by social observers.

Expertise Matters

Perception is subject to the same influences as human behavior, and thus learning shapes an individual's perception. Regardless of if social events are perceived directly or inferentially, it remains an open question what role, if any, expertise plays. Previous research has highlighted the importance of perceptual learning and attunement to task-specific information (Bingham, McConnell, & Muchisky, 2001). In their work (see also McConnell, Muchisky, & Bingham, 1997), the use of feedback in judgments about events was found to enhance the participants calibration to the task and allowed the participant to attune to specific features of the event properties of interest. Abernethy and Zawi (2007) examined expertise related differences in information uses between expert badminton players and non-expert badminton players using point-light displays. Their findings suggest that expertise plays a role in what information participants focused on during the experimental task.

Bläsing, Calvo-Merino, Cross, Jola, Honisch, and Stevens (2012) suggest that dance is a useful resource when researching movement and cognition. This paper also identifies a point made in earlier researcher in saying that the origins of dance are intrinsically linked to social interactions (Brown, Martinez, & Parsons, 2005). Bläsing et al. (2012) summarized the multiple aspects of embodied cognition involved in performing and perceiving dance. Dance requires enhanced sensorimotor and proprioceptive skills and the ability to encode sequences of movement. Experienced dancers show increased expertise in kinesthetic imagery tasks based on their use of motor imagery in dance training (Jeannerod & Pacherie, 2004). The idea of embodied cognition states that cognition manifests itself not only in the mind of the agent, but also the body (Wilson & Golonka, 2013). This suggests that an agent's mental state may be externalized to their body. Embodied cognition supports the idea of direct social perception, suggesting that an agent's mental state can be directly perceived from their externalized behavior (Wiltshire, Lobato, McConnell, & Fiore, 2015). This idea is consistent with KSD, which suggests that movement provides information about the causal factors of the movement, which in this case is the intention behind the action. Dance expertise requires dancers to embody emotions, suggesting that they will have increased expertise when perceiving emotions during social interaction. This raises the question of whether dancers are better at identifying target emotions from kinematics based on experience using motor imagery compared to non-dancers.

Past research has corroborated the idea that when observing actions, we internally simulate the observed movement using similar brain regions used when executing such movements. This has been described as the mirror neuron system (Grezes & Decety, 2001). Previous fMRI studies using a sample of contemporary dancers (Cross, Hamilton, & Grafton, 2006) showed increased activity in areas considered to be a part of the mirror neuron system when the dancers viewed movements they had performed before compared with movements they have not performed. This opens the question to consider whether these findings would be similar when viewing emotional dance stimuli for emotions they have expressed through dance.

Early research using point-light displays sought to investigate if point-light displays could depict dances, and how well emotions could be recognized in these dances (Walk & Homan, 1984). Results indicated that participants could identify dance from point-light displays and had somewhat accuracy when identifying the type of dance being displayed. In the same study, when labels were provided to pick from when identifying the type of dance, accuracy went up for recognition of emotion and dance type. In a more recent study, Brownlow, Dixon, Egbert, and Radcliffe (1997) examined if dance experience influenced attunements to dance movement. This study found that most participants, regardless of experience, could judge happy dances from sad. Dance experience allowed for more specific movement judgements of happy verses sad dances, that novices could not pick up on. These findings support ecological theory (McAurther & Barron, 1983), because it supports the idea that people are differently attuned to social information that is afforded to them by attending to different aspects of the stimuli they perceive. The idea that dancers are more attuned to certain aspects of stimuli is supported by other research which found that expertise in ballet is associated with higher perceptual sensitivity to subtle differences in movement when observing point-light displays (Calvo-Merino, Ehrenberg, Leung, Haggard, 2010). Other researchers have found that dance ability is associated with trait emotional intelligence (Petrides, Niven, & Mouskounti, 2016). Christensen, Gomila, Gaigg, Sivarajah, and Calvo-Merino (2016) found that motor expertise in emotionally expressive body movement modulated sensitivity when viewing others affective body movement. Their findings suggest the importance of replication to examine if these results will extend to different stimuli, such as more artistic or more everyday type expression of emotions.

Hypothesis

There have been few studies that assess how expertise in dance can play a role in perceiving emotions from kinematics. The present study aims to identify if experience in portraying emotions through dance will affect recognition of emotional body movement. This research will assess this by comparing recognition between novice viewers and those with dance experience. By using videos of point-light displays of movement, all extraneous factors that may affect recognition of emotions (such as music, background information, or facial expression) will be removed. The videos will display either anger, sadness, happiness, or fear. This experiment will use two conditions: experienced dancer viewing the stimuli, and novice viewers viewing the stimuli. The research hypothesis predicts that observers with dance experience will have higher accuracy on correct identification of emotions than non-dancers. Additionally, observers with dance experience will have faster reaction times (RT) across emotions when making these judgements than non-dance observers.

CHAPTER TWO: METHODS

Participants

Forty-four young adults ($N = 44$) ranging from 18-23 years of age ($M_{age}= 19$; $M_{female} = 27$, $M_{male} = 17$) were recruited to participate in this study. Twenty-one of the participants had dance experience ($n = 21$) and twenty-three participants ($n = 23$) had no dance experience. The participants in the dance group were recruited through the University of Central Florida's dance minor program's classes. The participants in the non-dance group were recruited from the University of Central Florida's Psychology department's participant pool website. Participants received extra or partial course credit in exchange for their participation.

Materials

The body movement stimulus set was created and used by Atkinson, Dittrich, Gemmell, and Young's (2004) experiment that aimed to see if neurological damage impaired the ability to recognize basic emotions from body movement. This stimulus set contained videos of emotion portrayals in point-light of four emotions: anger, fear, happiness, and sadness. The actor's joints were displayed using reflective tape so that only their joints (wrists, elbows, shoulders, hips, knees, and ankles) are shown against a black background. Ten different actors (five female and five male) displayed the emotions for a total of forty video clips. Each video clip was three seconds long.

The demographic questionnaire was administered through Qualtrics at the end of the experimental task. It collected basic demographic information about the participants age, biological sex, and ethnicity. In addition to demographic information, it asked about previous dance experience and if the participant was completing a dance minor at the University of Central Florida.

To run the experiment, an Alienware AW15R2 15.6-inch laptop running with an Nvidia GeForce GTX 970M graphics card running Windows 10 was used. Observers sat with their eyes 20 inches from the monitor. The experiment used PsychoPy v3.0 for stimulus presentation and response recording, including reaction time data.

Procedure

The study took place at the University of Central Florida's Psychology department as well as room #T105 of the University of Central Florida's Theater department. Upon arrival to the room, participants were presented a summary of the study and provided informed consent. Participants were asked to sit at a desk with minimal distractions where the computer was set up on the desk. They were instructed to respond quickly and try to answer as accurate as possible. The videos were presented in randomized order for a total of 40 trials, 10 for each emotion. After each video, participants were asked what emotion was displayed by the question appearing on a white screen and four choices being presented. They made judgments about what they saw by pressing a key on the keyboard as instruction ("1" for fear, "2" for sad, "3" for anger, "4" for happy). Their response time and accuracy were recorded. Participants filled out a demographic's questionnaire at the end.

CHAPTER 3: RESULTS

Outliers within the data were checked based on the RT across 1760 trials. Trials with a RT greater than 2SD (RT > 6.41s) from the mean were excluded from subsequent analysis. Fifty-four data points were removed out of 1760. For the dance group, the mean RT = 1.95s across emotions. For the non-dance group, the mean RT = 1.87s across emotions. After removing outliers, a mean accuracy and mean RT was calculated for each of the four emotions. The accuracy and RT means were analyzed using 4 × 2 mixed design ANOVA, where the between-subjects factor is dancer versus non-dancer and the within-subjects factor of emotion type.

Analysis of Accuracy Data

When comparing the mean accuracy time between the dance group and non-dance group, the dancers (fear: [*M* = .90, *SD* = .13], sad: [*M* = .85, *SD* = .14], anger: [*M* =.83, *SD* = .21], happy: [*M* = .90, *SD* = .11]) appeared to make about the same amount of accurate judgements as the non-dancer groups (fear: [*M* = .92, *SD* = .09], sad: [*M* = .87, *SD* = .12], anger: [*M* =.83, *SD* = .15], happy: [*M* = .87, *SD* = .11]). A 4 × 2 ANOVA on the accuracy data revealed no main effect of dance and non-dance groups $F(1,42) = .000$, $p = .98$, $\eta_p^2 = .000$. When looking at accuracy data across emotions regardless of groups, fear was most accurately recognized (*M* = .91, *SD* = .11). Happy was the second most accurately judged emotions (*M* = .88, *SD* = .11). The third and fourth were sad (*M* = .86, *SD* = .13) and anger (*M* = .83, *SD* = .18). There was a significant main effect of the emotion type $F(3,126) = 2.93$, $p = .036$, $\eta_p^2 = .065$. There was no interaction found between emotion and group $F(3,126) = .40$, $p = .75$, $\eta_p^2 = .009$. Additional analyses were run to examine the possibility of sex-specific effects but yielded no significant main effect or interaction of sex related differences.

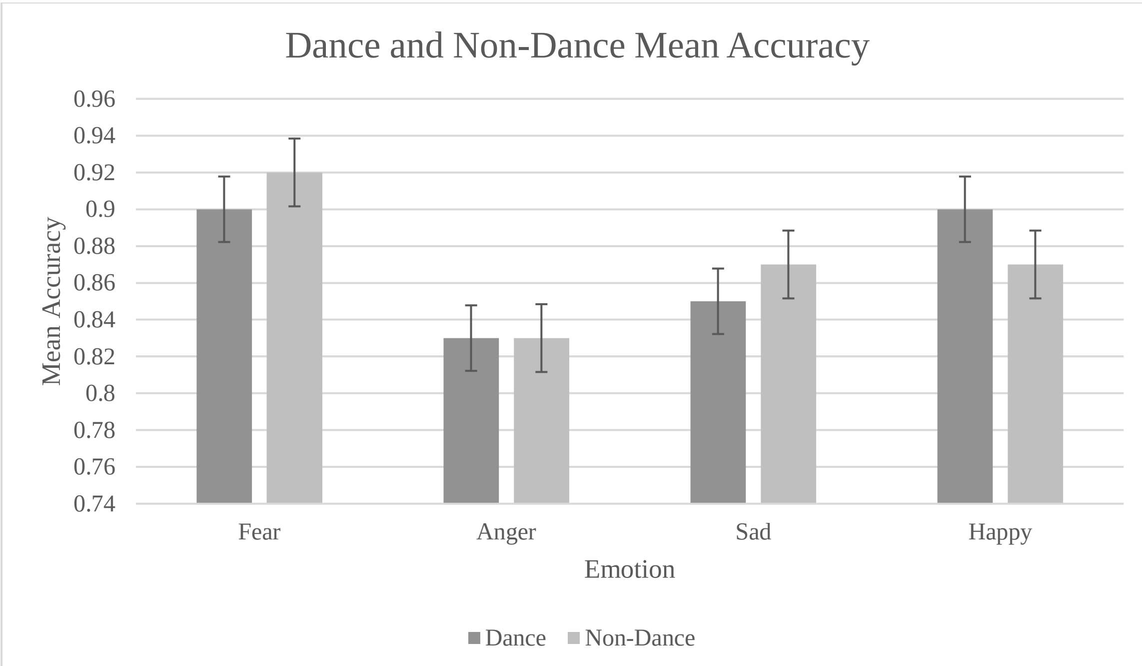

Figure 1. The mean accuracy data for the dance group and non-dance group.

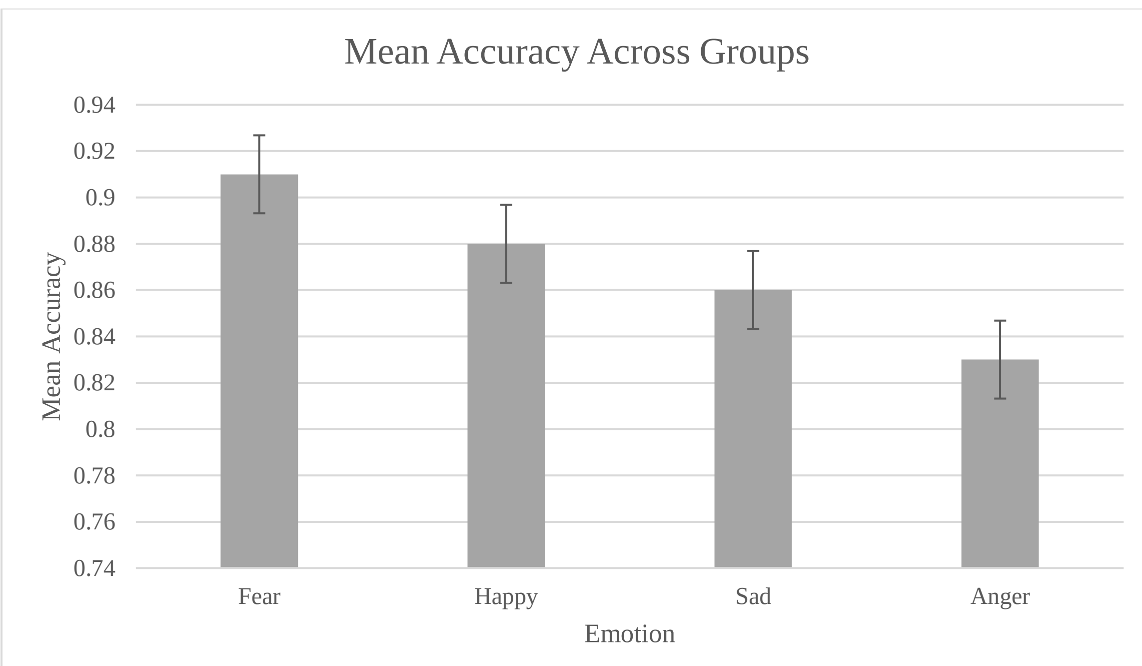

Figure 2. The mean accuracy data across groups.

Analysis of Reaction Time Data

The RT data showed that across groups, sad (*M* = 1.82, *SD* = 1.3) and fear (*M* = 1.77, *SD* = 1.04) videos had faster recognition times than happy (*M* = 1.9, *SD* = 1.24) and anger (*M* = 2.16, *SD* =1.42). A 4 × 2 ANOVA on revealed no significant main effect of emotion $F(3, 126) = 2.26$, $p = .085$, $\eta_p^2 = .051$. Comparing each emotion's mean RT showed that the dancer (fear: [*M* = 1.81, *SD* = 1.10], sad: [*M* = 1.92, *SD* = 1.38], anger: [*M* =2.15, *SD* = 1.18], happy: [*M* = 1.94, *SD* = 1.48]) and non-dancer group (fear: [*M* = 1.82, *SD* = 1.49], sad: [*M* = 1.64, *SD* = .57], anger: [*M* =2.17, *SD* = 1.63], happy: [*M* = 1.89, *SD* = .99]) had similar mean RT for each emotion. A 4 × 2 ANOVA revealed no significant group main effect $F(1,42) = .06$, $p = .80$, $\eta_p^2 = .001$. There was no significant interaction between emotion and group $F(3,126) = .40$, $p = .75$, $\eta_p^2 = .009$. Additional analysis was run to examine any sex-specific effects for RT but yielded no significant differences.

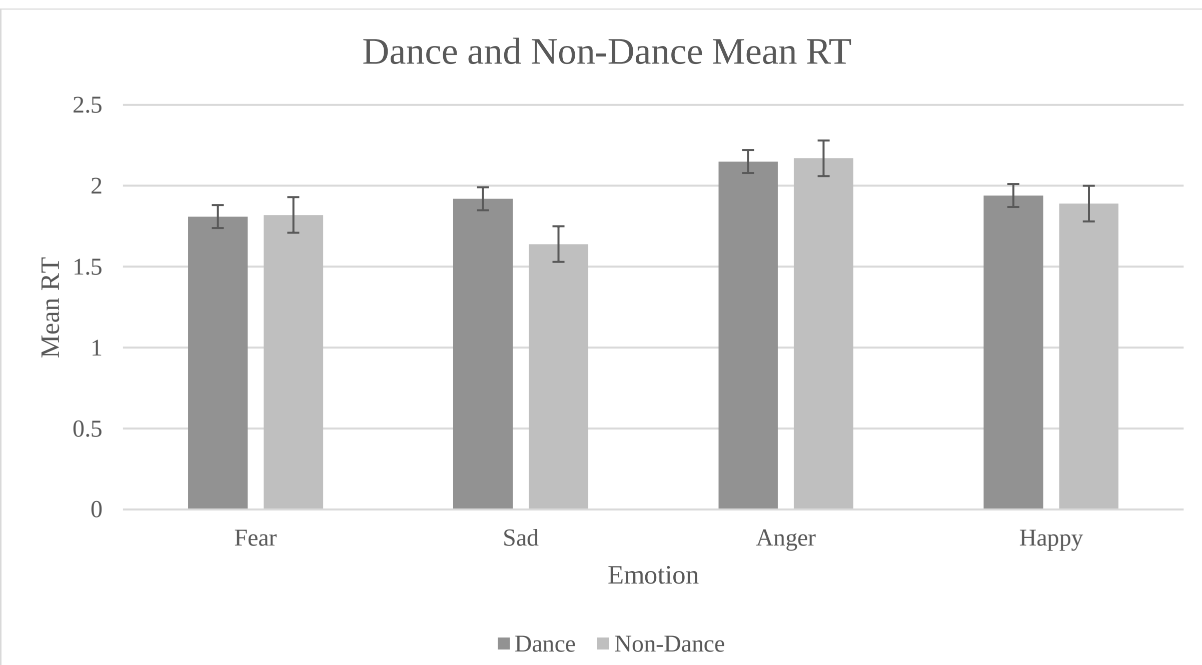

Figure 3. The mean RT for the dance group and non-dance group.

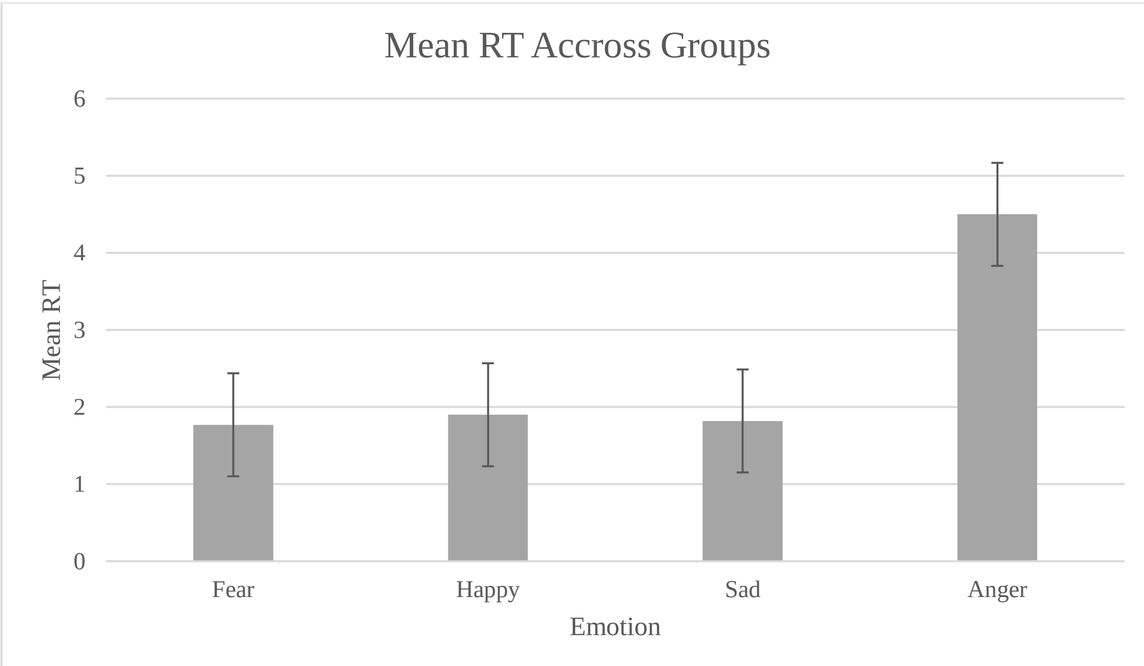

Figure 4. The mean RT across groups.

CHAPTER 4: DISCUSION

The goal of this study was to determine if dance expertise played a role in perceiving emotions through body movement. It was hypothesized that dancers would have increased accuracy when making judgments about what emotion was being displayed in point-light videos. In addition, it was hypothesized that dancers would have a faster RT than non-dancers. This was hypothesized based on the idea that dancers have more experience embodying emotions through their own body movement. It was thought that because of their experience displaying emotions with their body, dancers would do better on the experimental task.

The findings did not support the hypothesis. There was no difference in accuracy or RT when comparing the dance and non-dance group. There was a difference in detection accuracy as a function of emotion, but no differences as a function of dance experience. Dance experience did not interact with emotion type. The two groups had similar accuracy scores and RT for each emotion, suggesting that dance experience did not play a role in the participants judgements of each emotion.

The accuracy data yielded a significant main effect of emotion type. Both groups had increased accuracy when identifying fear and happiness compared to anger and sadness. Additionally, the videos displaying sadness and fear had faster mean RT than happiness and anger. The emotion with the highest mean RT and least mean accuracy was anger. This suggests that out of all the emotions presented in this experiment, participants had increased difficulty judging a video as anger. This could be explained by how the stimulus was created. There is a difference between natural body movements that occur when expressing an emotion and asking someone to force the emotion through their body movement. It could have been that fear and happiness were more accurately produced to look natural, where anger and sadness were less natural. The fear and happiness videos may have had more obvious movements that indicated the emotion. The findings are inconsistent with previous studies that have found sex differences on accuracy during bodily emotion recognition tasks using point light displays (Alaerts, Nackaerts, Meyns, Swinnen, & Wenderoth, 2011). This suggests that the results are tied to the stimulus used, indicating a need for future research to further explore this question.

Limitations

There were a few limitations experienced during the completion of this study. The intention of this study was to assess if dance expertise could modulate increased perceptual sensitivity when perceiving emotions. For this study, dance expertise was defined an undergraduate student currently completing a dance minor at the University of Central Florida. While the minor requires an intense audition, this does not necessarily mean that the dancers were experts in their field. The dancers may have had more experience than a participant who had never set foot in a dance class, but the differences may not have been as pronounced as it would have been with a professional dancer. Additionally, the stimuli that was utilized only displayed emotions presented through everyday movement. It is possible that the task was too easy, resulting in both groups having similar mean accuracy and RT.

Future Research

Future research should address the limitations previously stated. How expertise is defined should be addressed and improved upon. Future researchers should attempt to have professional dancers participate in the study. If a sample of professional dancers is not available, expertise could be extended to using professional actors, as both groups have increased experience in displaying emotions through body movement. Additionally, using stimuli that displayed both everyday of emotion as well as dancers displaying the emotion could improve the experimental task.

It is also important to consider perceptual learning in social event perception. Previous research has found that giving feedback when making judgments about events enhanced the participants calibration to the task, allowing the participant to attune to specific features of the event (Bingham, McConnell & Muchisky, 2001; McConnell, Muchisky, & Bingham, 1997). Future research should assess differences in the use of feedback for experts compared to novice viewers. Previous research has found differences in how experts and novice viewers use information when making judgments about badminton plays (Abernethy & Zawi, 2007). It is possible that experts may be more receptive to task-specific feedback.

Conclusion

The purpose of the current study was to examine if expertise played a role in social event perception. This study sought to examine if dancers, who have increased experience in portraying emotions through dance, had increased perceptual sensitivity to perceiving emotions than non-dancers. It was hypothesized that dancers would have increased accuracy and RT compared to non-dancers when making judgements about emotional body movement. The results rejected this hypothesis, suggesting dance expertise does not play a role in perceiving emotion.

APPENDIX A: FIGURES

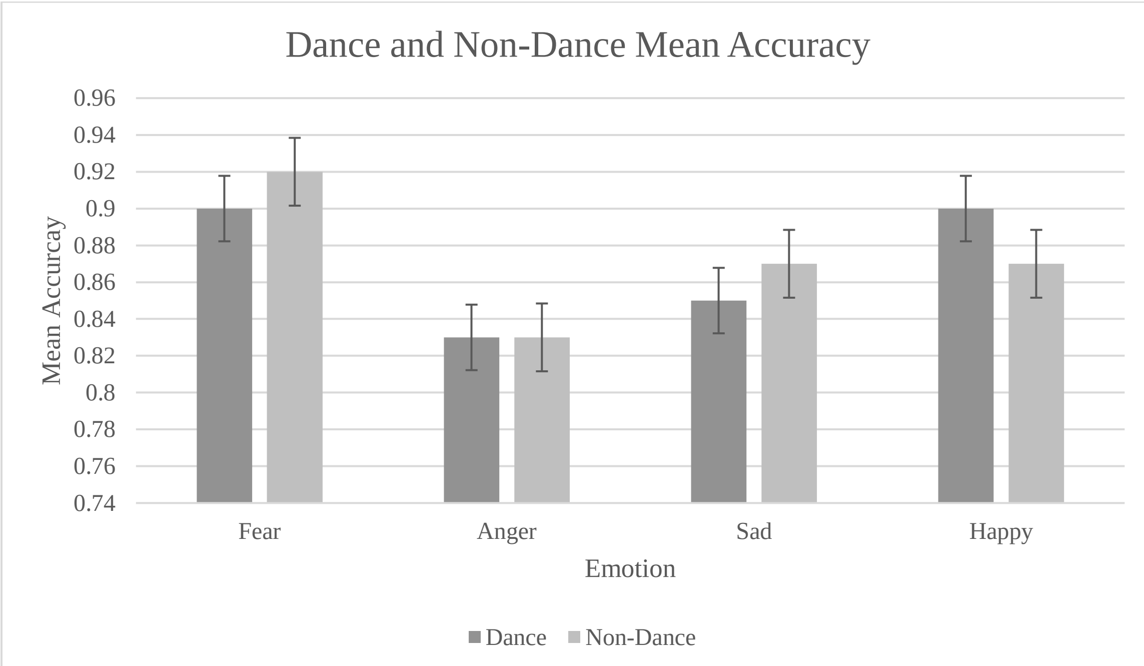

Figure 1. The mean accuracy data for the dance group and non-dance group.

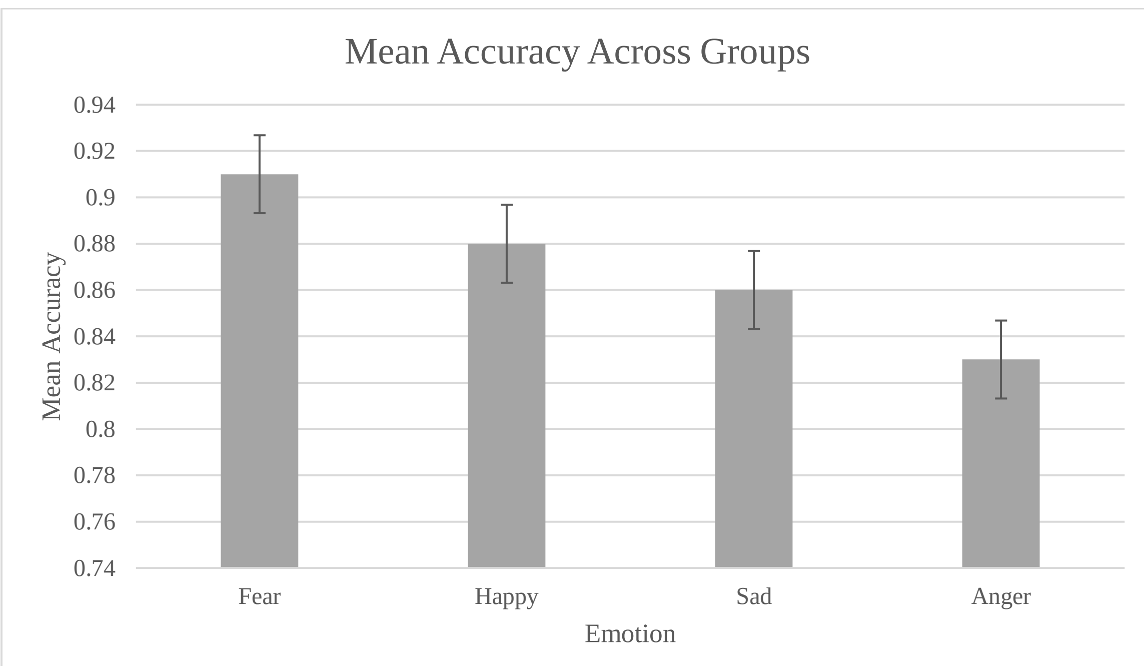

Figure 2. The mean accuracy data across groups.

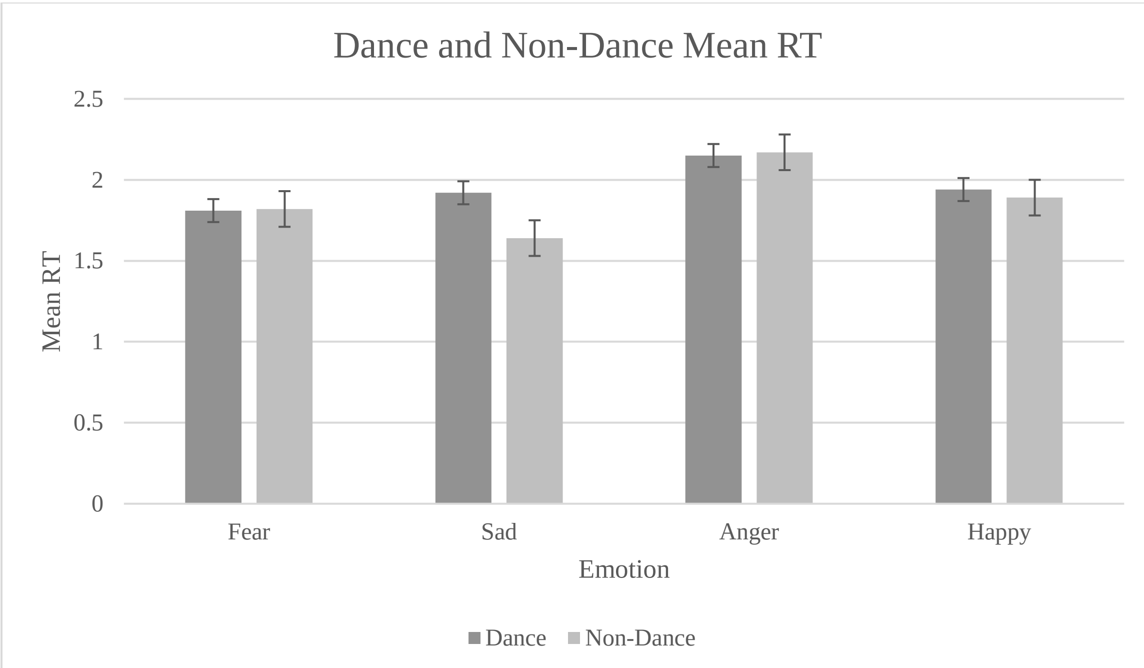

Figure 3. The mean RT for the dance group and non-dance group.

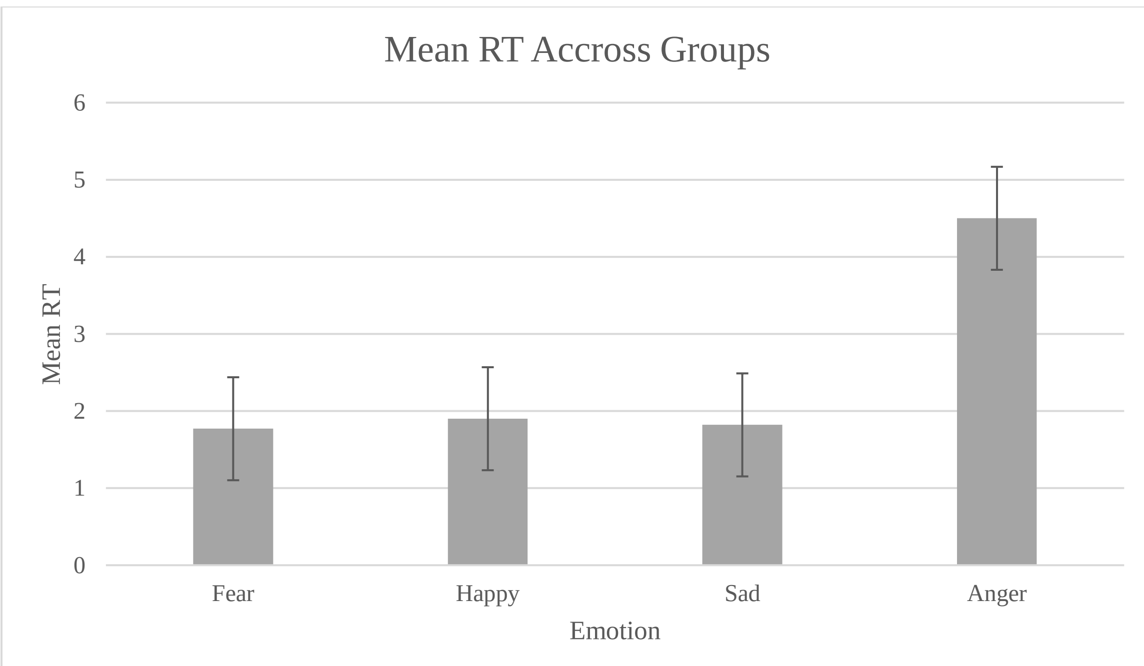

Figure 4. The mean RT across groups.

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