

Emotional Language and Gesture Production of Preschoolers

by

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Emotional Language and Gesture Production of Preschoolers

Koç University

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This is to certify that I have examined this copy of a master's thesis by

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I dedicated my thesis to my grandmother, Yeter Civelek.

ABSTRACT

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Children's understanding and learning of emotion concepts are important for their social-cognitive development and their general and emotion-specific language skills. As language is multimodal, co-speech gestures children use can also be associated with their emotion understanding. This study examined 4- to 6-year-old children's (n=67) multimodal language use for emotions and its link to their emotion understanding. Children's use of emotional speech and multimodal emotional talk were assessed with an Emotional-Narrative Task that included negative, positive and neutral stories. Emotion understanding was assessed via the Emotion-Matching Task with four subtasks: Expression-Matching Knowledge, Emotion-Situation Knowledge, Expressive-Emotion Knowledge, and Receptive-Emotion Knowledge. We asked three questions: (1) Did children's emotion understanding differ by age from 4-year to 6-year (2) Did children produce more emotional multimodal language (speech + gesture) in emotional stories compared to neutral stories? (3) Was children's emotion understanding in different tasks, including both general and situation related emotional knowledge, predicted by children's emotional talk and gestures? Results showed that age was significantly correlated with the total score in the Emotion-Matching Task. Children produced significantly more multimodal emotional talk in the negative story than the neutral story. Children's Emotion-Matching Task scores, particularly for the Receptive-Emotion Knowledge test, were predicted by multimodal emotional talk, controlling for age, gender, and general language skills. Thus, multimodal emotional language could be associated with emotion concept development. This study contributed to the field by explaining the relationship between concept learning and multimodal language demonstrated by abstract emotion concepts.

Keywords: Emotional Language, Gesture, Emotion Understanding

ÖZETÇE

Okul Öncesi Dönem Çocuklarında Duygusal Dil ve Jest Üretimi

Hazal Civelek

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Çocukların duygu kavramlarını anlamaları ve öğrenmeleri sosyal-bilişsel gelişimleri açısından önemlidir. Çocukların duyguyu anlamaları onların genel ve duyguya özel dil becerileriyle ilişkilidir. Dil multimodal olduğundan, çocukların konuşmaya eşlik eden jestler kullanmaları da duygu kavramlarını anlamalarıyla ilişkilendirilebilir. Bu çalışma 4-6 yaş arası çocukların (n=67) duygusal multimodal dil kullanımını ve bunun duygu konseptlerini anlamalarıyla bağlantısını incelemektedir. Çocukların duygusal konuşma ve multimodal duygusal konuşma kullanımı, olumsuz, olumlu ve nötr hikayeleri içeren bir Duygusal Anlatı Görevi ile değerlendirildi. Duygu anlayışı, dört alt görev içeren Duygu Eşleştirme Görevi aracılığıyla değerlendirildi: İfade Eşleştirme Bilgisi, Duygu Durum Bilgisi, İfade Edici Duygu Bilgisi ve Alıcı Duygu Bilgisi. Üç soru sorduk: (1) Çocukların duygu anlayışı 4 yaştan 6 yaşa kadar yaşa göre farklılık gösterdi mi? (2) Çocuklar, nötr hikayelere kıyasla duygusal hikayelerde daha fazla duygusal multimodal dil (konuşma + jest) üretti mi? (3) Çocukların genel ve durumla ilgili duygusal bilgisi de dahil olmak üzere farklı görevlerdeki duygu anlayışı, çocukların duygusal konuşmaları ve jestleri tarafından tahmin edildi mi? Sonuçlar, yaşın Duygu Eşleştirme Görevi'ndeki toplam puanla ilişkili olduğunu gösterdi. Çocuklar, olumsuz hikayede nötr hikayeye göre daha fazla multimodal duygusal konuşma ürettiler. Çocukların Duygu Eşleştirme Görevi puanları, özellikle Alıcı Duygu Bilgisi puanları, yaş, cinsiyet ve genel dil becerileri kontrol edilerek bakıldığında multimodal duygusal dil tarafından tahmin edildi. Bu nedenle, multimodal duygusal dil, duygu kavramı gelişimi ile ilişkilendirilebilir. Bu çalışma, kavram öğrenimi ile soyut duygu kavramları arasındaki ilişkiyi multimodal dil kullanımı ile açıklayarak alana katkıda bulunmuştur.

Anahtar Kelimeler: Duygusal Dil, Jest, Duygu Anlama

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TABLE OF CONTENTS

List of Tables	ix
List of Figures.....	x
Abbreviations.....	xi
Chapter 1: Introduction.....	1
1.1 Development of Emotion Understanding	1
1.2 Emotional Language and Emotion Understanding.....	2
1.3 Emotion Understanding and Gesture	5
1.4 The Current Study.....	6
Chapter 2: METHOD	9
2.1 Participants.....	9
2.2 Measures	9
2.2.1 Cartoon retelling Task	9
2.2.2 Emotion Matching Task.....	9
2.2.3 Emotion Narrative Task.....	12
2.3 Procedure	13
2.4 Coding.....	14
2.4.1 Linguistic Complexity Coding.....	14
2.4.2 Emotional Language Coding	14
2.4.3 Gesture Coding	15
2.4.4 Gesture Coding	15
Chapter 3: Results.....	16
3.1 Descriptive Statistics and Preliminary Analysis.....	16
3.1.1 Descriptive Statistics of Demographic Variables	16
3.1.2 Descriptive Statistics of Emotion Narrative Task.....	16
3.1.3 Preliminary Analysis.....	17
3.2 Main Analysis	18

Chapter 4: DISCUSSION	24
Chapter 5: CONCLUSION.....	28
REFERENCES	29
Appendix A: Emotion Narrative Task Coding	35



LIST OF TABLES

Table 3.1.	16
Table 3.2.	17
Table 3.3	18
Table 3.4.	19
Table 3.5.	21
Table 3.6.	22



LIST OF FIGURES

Figure 2.1: Sample trials from the Emotion-Matching Task (EMT).....	11
Figure 2.2: The displays of each emotion condition in the Emotion-Narrative Task (2.2.a.: Negative, 2.2.b.: Positive, and 2.2.c.: Neutral).....	13



ABBREVIATIONS

EMT	Emotion Matching Task
ENT	Emotion Narrative Task
GAES	Gesture Accompanied by Emotional Speech
ES	Emotional Speech



Chapter 1:

INTRODUCTION

Emotion understanding, the capacity to interpret and identify emotion categories (Pons & Harris, 2019), is essential for children's socio-cognitive development (Denham et al., 2003). Emotion understanding requires many skills such as interpreting facial expressions, bodily cues, and vocal tones of emotions and having knowledge about expected emotional reactions (Ogren & Johnson, 2020). Several factors such as gender (Cunningham et al., 2009), parental emotional talk input (Tompkins et al., 2018), and socio-economic status (SES, Cutting & Dunn, 1999) are related to emotion understanding of children. Among these factors, children's general and emotion-specific language use are found to be linked to their emotion understanding (e.g., Pons et al., 2003, Streubel et al., 2020). However, language is multimodal, which includes hand gestures in addition to verbal information. Little is known about how co-speech hand gestures reflect and assist the development of emotion understanding (Vallotton & Ayoub, 2010). This study investigates association between 4- to 6-year-old children's emotional language and gesture use and their emotion understanding.

1.1 Development of Emotion Understanding

The development of emotional understanding begins at infancy. Infants can distinguish vocal tones and facial expressions, suggesting an ability to recognize emotions (LaBarbera et al., 1976; Walker-Andrews & Grolnick, 1983). After infancy, toddlers start to use emotion labels (Ridgeway et al., 1985) and match these labels with facial expressions (Denham, 1986). During the preschool period, children start to distinguish the causes of emotions and emotional reactions (Denham, 1998; Harris, 1989), which helps them evaluate emotions in situations (Denham, 1998). Later in primary school years, emotion regulation develops (Schultz et al., 2001). Although

these developmental changes occur similarly across children, there is also variance in terms of emotion understanding capacities. For example, Ogren et al. (2018) explain some of the variance in emotion understanding with individual differences in how family members express emotions.

Emotion understanding is related to factors that can affect children's lives (Denham et al., 2012; Schultz et al., 2001). Children's emotion regulation skills can be determined by their understanding of emotions. In addition, children's well-being may also be related to their emotion understanding capacities (Schultz et al., 2001). Emotion understanding is important to maintain social interactions with other people (Izard et al., 2001). Additionally, children with higher emotional understanding form healthier relationships and their academic success is also linked to their understanding of emotions (Denham et al., 2012). For these reasons, it is of great importance to examine the factors that may be related to the development of children's emotional understanding. These factors include gender (Cunningham et al., 2009), parental input (Tompkins et al., 2018), SES (Cutting & Dunn, 1999), and language skills (Beck et al., 2012; Grazzani & Ornaghi, 2011). In this study, we focus on how children's multimodal language skills are associated with their emotion understanding.

1.2 Emotional Language and Emotion Understanding

The connection between language and emotion categories has been studied by researchers for a relatively long time. According to the Conceptual Act Theory (CAT; Barrett, 2006; Lindquist et al., 2016), conceptual knowledge of emotion categories constructs emotions. Emotions are constructed via basic elements, such as affect, perception, and conceptual knowledge of emotion categories in a specific culture. Affect reflects sensation representation coming from the inner body. Perception reflects sensation representations from the outside of the body via perceptual channels. The CAT suggests that when a person senses an affect or perceives another's affect, she would make meaning via their conceptual knowledge of emotion categories. How do children's conceptual knowledge help construct emotion categories? Previous work suggested the role of language in emotion concept learning like other abstract concept learning (see Barsalou & Wiemer-Hastings, 2005).

Children's learning of abstract concepts (Condry & Spelke, 2008; Granito et al., 2015) is linked to their word knowledge (Waxman & Booth, 2003). As emotion categories are abstract concepts, children's language and word knowledge has an impact on their learning them (see Michaud et al., 2021; Nook et al., 2020; Price et al., 2022). Receptive vocabulary, narrative skills have a positive relationship with children's emotion understanding in via facial emotion recognition (Cutting & Dunn, 1999). Similar findings were obtained for complex emotions, such as embarrassment and pride (Bosacki & Moore, 2004). Pons et al. (2003) assessed general language skills and their relation to emotion understanding in 4- to 11-year-old children and found that emotion understanding was predicted by the general language skills of children, even when age was controlled. Thus, the significant relation between emotion understanding and language skills is not only a consequence of aging during childhood. Together, these studies suggest that language skills are important factors that contribute to variance in children's emotion understanding.

Although most studies are concerned with the predictive role of children's general language skills on emotion understanding, others suggest that emotion understanding could be predicted by specific emotion word learning (Barrett, 2017; Kopp, 1989), which is supported by empirical evidence (Beck et al., 2012; Ornaghi & Grazzani, 2013; Streubel et al., 2020). For instance, Streubel et al. (2020) examined the role of emotion-specific vocabulary use in 4- to 9-year-old children's emotion knowledge and emotion regulation strategies. They investigated the role of size and depth of children's emotion-specific vocabulary use and general language skills in children's early- and later-acquired components of emotion understanding such as facial emotion recognition (early-acquired component) and knowledge of emotion regulation strategies (later-acquired component). The results highlighted the predictive role of emotion-specific vocabulary size in children's early-acquired components of emotion understanding, beyond overall language skills. Children's size of emotion-specific vocabulary use was related to the later-acquired components of emotion understanding, such as emotion regulation strategies knowledge.

Beyond the vocabulary knowledge about emotions, children's use of these emotional words in communication is a factor that contributes to emotion understanding (Grazzani & Ornaghi, 2011). Children can benefit from the increased use of emotional talk in their social life. When the frequency and quality of communication about

emotions increase, children's emotion understanding also increases (Grazzani & Ornaghi, 2011; Ornaghi & Grazzani, 2013). For instance, parents' higher quality and frequency of emotional talk benefit children's understanding of emotions (Aznar & Tenenbaum, 2013; Chan et al., 2023; Tao et al., 2013). Furthermore, an intervention study (Grazzani & Ornaghi, 2011) found a significant effect of emotional talk on 3- to 5-year old children's emotion understanding. In this intervention study, both control and experimental groups were exposed to a story-reading session and these stories included emotion-related words. However, only the experimental group was asked to communicate about emotions after the story-reading. All participants were assessed in their emotion understanding at pre- and post-intervention phases. Children's performances in emotion understanding tasks were higher in the intervention group than children in the control group, even though their performances were similar before the intervention. Another study found a significant correlation between emotion understanding and both use and comprehension of emotional lexicon in primary school students (Ornaghi & Grazzani, 2013). Thus, communicating and talking about emotions is a contributing factor to the emotion understanding of children.

Emotion situation knowledge, which is understanding the causes of emotions and what circumstances trigger specific emotions (Brody & Harrison, 1987; Denham, 2003), is another aspect of emotion understanding. Children's emotion situation knowledge develops during preschool years (Denham, 2003). Similar to other types of emotion understanding, emotion situation knowledge is also linked to language (Doan & Wang, 2010; Salmon et al., 2013). For instance, parental talk about emotions and their causes are related to children's emotion-situation knowledge (Doan & Wang, 2010). Additionally, in an intervention study, two groups of participants were exposed to causal talk in joint-narrative sessions. One of the groups received causal talk that contained emotions and the other group did not. Children's emotion-situation knowledge, as well as other components of emotion understanding, such as receptive and expressive emotion word knowledge, and emotion expression-matching knowledge (i.e. matching emotional facial expressions), were assessed. The findings demonstrated that children who were exposed to emotional causal talk performed better performance in expressive emotion knowledge task. However, no significant association was found between children's emotion situation knowledge and their use of emotion-situation talk (Salmon et al., 2013).

1.3 Emotion Understanding and Gesture

Language encompasses more than spoken communication, which is a complex system shaped and employed multimodally (Kendon, 1994, 2004; Kita, 2000; McNeill, 2005). According to Kendon (1988), hand gestures, one of these multimodal channels, can be accompanied by speech. These hand gestures are categorized as “deictic” for pointing at objects or abstract entities, “iconic” gestures that refer to observable actions and objects by representing them, and “metaphoric gestures” that refer to abstract concepts. Gestures that comply with a rhythm but do not refer to any object or action are called “beat gestures” (McNeill, 1992). According to Kita et al.’s (2017) gesture for conceptualization hypothesis, gestures are not only used for communication purposes but also have a self-oriented function, which benefit individuals’ conceptualization of information. Although Kita et al. (2017) suggest that this information may be spatial and motoric, gestures can also help conceptualize abstract information such as time. Nevertheless, the inclusion of co-speech gestures in emotional discourse remains a topic of debate. This is primarily due to the fact that existing explanations of gestures predominantly focus on concrete concepts, and even when abstract concepts are mentioned, such as time (Casasanto & Jasmin, 2012), they still incorporate spatial and motoric elements (Aslan et al., 2024; Kelly & Tran, 2023).

Some adult studies have examined the role of gestures in emotion understanding (e.g., Asalıoğlu & Göksun, 2023; Dael et al., 2013). For example, Asalıoğlu and Göksun (2023) conducted experiments to understand the role of hand gestures with different characteristics, such as gesture size and type, in emotion intensity comprehension. They found that the size of hand gestures had an impact on evaluating the intensity of emotions. Another study investigated the role of facial expressions as gestural cues in emotion communication (Ekman, 1992). However, only a few of studies investigated the production of hand gestures during emotional talk (e.g., Çatak et al., 2018; Özder et al., 2023).

When we examine the use of gestures from a developmental perspective, gestures’ role and presence before the formation of concepts seem to be highlighted (Goldin-Meadow, 2003). For example, gestures foster learning math concepts (Goldin-Meadow et al., 2009), spatial cognition (Miller et al., 2020), and problem-solving (Kirk & Lewis, 2017). Similar to the adult studies, developmental studies have generally

examined the relationship between concepts, which are adapted to concrete or spatial-motoric information, and gestures. Studies of concepts that do not directly contain spatial-motoric information, such as emotions, are also few in the developmental psychology field. For this reason, it is important to investigate whether emotion concept learning is linked to gesture use.

Studies on emotion understanding and gesture, revealed that children, even toddlers, use gestures for communication and conceptualizing social-emotional concepts (Vallotton, 2008; Vallotton & Ayoub, 2010). In an observational study, conversations between infants and toddlers, and their caregivers were investigated. Caregivers were taught about using gestures when they are giving information about emotions and asked to show these gestures to their children. Later, children's use of emotion gestures were coded. Results showed that infants and toddlers could produce emotion gestures, modeling after their caregivers (Vallotton, 2008). In a longitudinal study, child-mother interactions in play sessions were investigated when children were 14-, 24- and 36-months. Their emotion gestures and words, and social-emotional concept displays were coded. For instance, if children had displayed hostile and destructive action, then it would have been coded as an aggression concept. If children had displayed a caring action, it would have been coded as an affection concept. Results indicated that early pointing use at 14-month predicted children's later emotional conceptual displays (Vallotton & Ayoub, 2010). Therefore, this study suggests that to conceptualize emotions, children could benefit from gestures.

1.4 The Current Study

The current study contributes to the field in the aspects of understanding the role of multimodal emotional language use in the development of emotion understanding. Children's understanding of emotions is related to the multimodal channels of language (Vallotton, 2008). Emotional talk (Grazzani & Ornaghi, 2011) and gesture use (Vallotton & Ayoub, 2010) predict concept knowledge about emotion categories. At the same time, children begin to learn situation concepts between ages 3 and 6 (Denham, 1998). Taking these into consideration, this study investigated 4- to 6-year-old Turkish-speaking children's emotional talk multimodally and how this talk related to their

emotion understanding. We also aimed to understand the predictive role of hand gestures in emotion-situation concept acquisition.

We asked three questions: First, did children's emotion understanding differ by age from 48 months to 60 months? Second, did children produce more multimodal emotional language (speech + gesture) in emotional stories compared to the neutral story? Third, was children's emotion understanding at different tasks, including both general and situation-related emotional knowledge, predicted by the quality and frequency of children's emotional talk and gestures?

To examine our research questions, we administered three different tasks. First, we used the Emotion-Matching Task (Izard et al., 2003) to measure children's emotion understanding and emotion-situation concept knowledge. This task measures four components of emotion understanding, receptive and expressive emotion knowledge, emotion-situation knowledge, and expression-matching knowledge. Second, we used a newly created Emotion-Narrative Task to measure children's emotional talk and accompanying gesture use during emotional talk. For this task, we used three illustrative stories of situations: negative, positive, and neutral. Last, we used a Cartoon-Retelling Task to assess children's overall language.

For the first question, we hypothesized that (H1) older children would perform better overall in the emotion-matching task than younger children. More specifically, (H1a) older children would perform better in emotion-situation knowledge part of the emotion-matching task than younger children. We expected this result because emotion-situation is one of the late acquired components of emotion understanding and it is expected to continue to develop in 3- to 6- year old children. Thus, there should be variance explained by age. We did not expect a relation between age and receptive emotion knowledge as receptive emotion knowledge is first emerged component of the task. Therefore, 4- to 6-year-old children are expected to acquire receptive-emotion knowledge. Emotion expression matching knowledge and expressive emotion knowledge components were also expected to be related to increases in age.

For the second question, we hypothesized that (H2) there would be a significant difference of children's emotional talk frequency and quality between emotional stories and neutral stories, and (H2a) children would use more gestures that accompanied emotional talk in emotional stories than the neutral story. Additionally, (H2b) there

would be a significant difference of children's overall gesture use in emotional stories than the neutral story.

For the third question, we hypothesized that (H3) after controlling for age and general language scores of children, variance in emotion understanding would be explained better with multimodal emotional talk (speech + gesture) than only emotional talk (speech). We also hypothesized that (H3a) children's emotion-situation knowledge would be explained better with multimodal emotional talk about situations (speech + gesture) than only emotional talk about situations. (H3b) After controlling for age and general language scores of children, children's gesture use would also play a role in emotion understanding scores.



Chapter 2: METHOD

2.1 *Participants*

A priori power analysis was conducted via G*Power (Faul et al., 2009). Results determined that 78 participants were required when alpha level is set as .05 and effect size assumed as .15, to get .80 of power in the step-wise regression analysis, controlling for age and language abilities. Participants were 4- to 6-year-old Turkish-speaking preschoolers at private institutions in Çorlu, a district of Tekirdağ. Data were collected from 77 participants (Mage = 59.4 months, SDage = 7.24, 48 females). However, 5 children did not want to attend more than half of the study and 5 of the children's audios could not be transcribed as they were not heard clearly. Therefore, 10 children were excluded from the study. The final sample consisted of 67 participants (Mage = 58.5 months, SDage = 6.58, 38 females). Informed consent was obtained from the parents. Koç University's Institutional Review Board approved the study (Project name: Emotional Language Development and Gesture Production of Preschoolers - Protocol no: 2023.099.IRB3.043).

2.2 *Measures*

2.2.1 *Cartoon retelling Task*

This task was used to assess children's linguistic skills. Participants watched a cartoon video about two octopi. Then, participants were asked to retell the video. We used this task to measure children's general language skills, such as linguistic complexity.

2.2.2 *Emotion Matching Task*

This task assesses children's emotion knowledge in the aspects of happiness, sadness, anger, and surprise/fear (Izard et al., 2003). Surprise and fear emotional facial expression are combined for this study, because children may confuse to distinguish fearful and surprised facial expressions (Young, 2014). An adapted version of this task was used. The pictures of the tasks were adapted and the same procedure was used with

different pictures. The adapted emotional face pictures were extracted from The Child's Affective Facial Expression (CAFE) set (LoBue & Thrasher, 2014). The pictures that were rated correctly by the participants of the LoBue and Trasher (2014)'s study (with above 60% accuracy) were selected. For instance, if the child in the picture displays emotion of sadness, and the display is rated above 60% sad, the picture was selected to use in the EMT. In the original EMT, there are pictures of children with different ethnic backgrounds. However, we only used pictures driven from CAFE set that are compatible with Turkish faces. In other words, original EMT task consists of children pictures with ethnical diversities. We used children pictures from CAFÉ set to adapt the task to Turkish cultural and ethnical background.

The EMT has four parts: emotion expression matching, emotion situation knowledge, expressive emotion knowledge, and receptive emotion knowledge. In total, the task included 48 items (12 items for each part). All emotion categories (anger, happiness, sadness, and fear-surprise) were represented 3 times in every part of the task. In the Emotion-Expression Matching Task, children were asked to match the target picture, which contained a certain emotional face, with a set of four photographs (3 distractors). In the Emotion-Situation Knowledge Task, children were asked to match pictures with given causes or situations verbally. In the Expressive-Emotion Knowledge Task, children were asked to produce emotional labels for pictures. In the Receptive-Emotion Knowledge Task, children were asked to match labels with pictures. 24 female and 24 male target pictures were presented. If the target contained female pictures, then the distractors and the second targets would also contain female pictures. There were two orders of the EMT. In these orders, the position of distractors was different, even when the same questions were asked. In both orders, the question with the answer in the same position did not appear 3 times in a row, and the same emotion did not become the target 3 times in a row. Figure 2.1. indicates the procedure of EMT with all tasks.

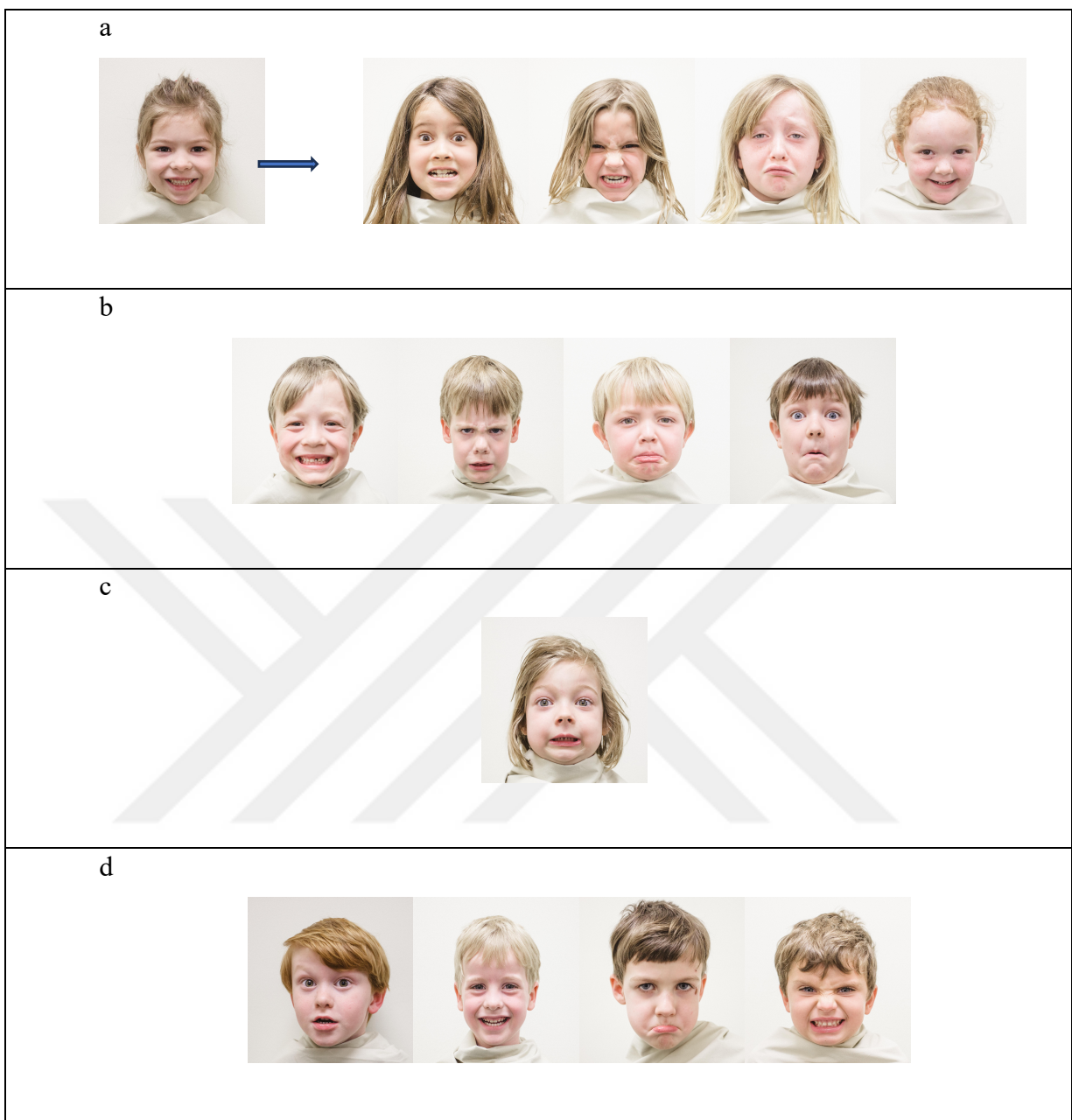


Figure 2.1: Sample trials from the Emotion-Matching Task (EMT).

In Figure 2.1.a., participants were asked to match the first emotion with one of the four options (Emotion-Expression Matching). In Figure 2.1.b., participants were asked to choose one of the options that was compatible with the given emotional situation (Emotion-Situation Knowledge). In Figure 2.1.c., participants were asked to express emotions given in the picture (Expressive-Emotion Knowledge). In Figure 2.1.d., participants were asked to choose one of the options that is compatible with the given emotion category (Receptive-Emotion Knowledge).

2.2.3 *Emotion Narrative Task*

This task assessed children's narrative production in three conditions: (1) the positive emotional condition, (2) the negative emotional condition, and (3) the neutral situation condition. In three condition, participants are asked to narrate illustrative stories about two children. In the positive emotional condition, participants were asked to tell a narrative about positive emotions in different situations. For instance, in the illustrations the children's grandmother give them presents. In the negative emotional condition, participants were asked to tell a narrative about negative emotions in different situations. For instance, in the illustrations, the children's dog gets sick, and a friend makes fun of them. In the neutral situation condition, participants were asked to tell a narrative about pictures that did not include any emotional cues in different situations, such as two children moving an object, a ball. The experimenter did not mention anything about the emotions in the pictures. All pictures for each emotion condition were presented at the same time to the child. Figure 2.2. indicates the illustrations that were used in this task.

We piloted the narrative task stimuli with adults ($n= 27$, $Mage= 21.9$, $SD= 1.54$). For the positive emotional narrative, 88.9% ($SD= 1.47$) of the participants used at least one positive emotion word in their narratives. For the negative emotional narrative, 92.6% ($SD=1.26$) of the participants used at least one negative emotion word in their narratives. Last, for the neutral emotional narrative, 88.9% ($SD= .56$) of the participants did not use any emotion terms in their narratives.

Additionally, 77.8% of participants talk about emotional situations at least once in positive ($SD= .85$) and negative ($SD= 1.19$) narratives. None of the participants talked about emotion situations in the neutral narrative.

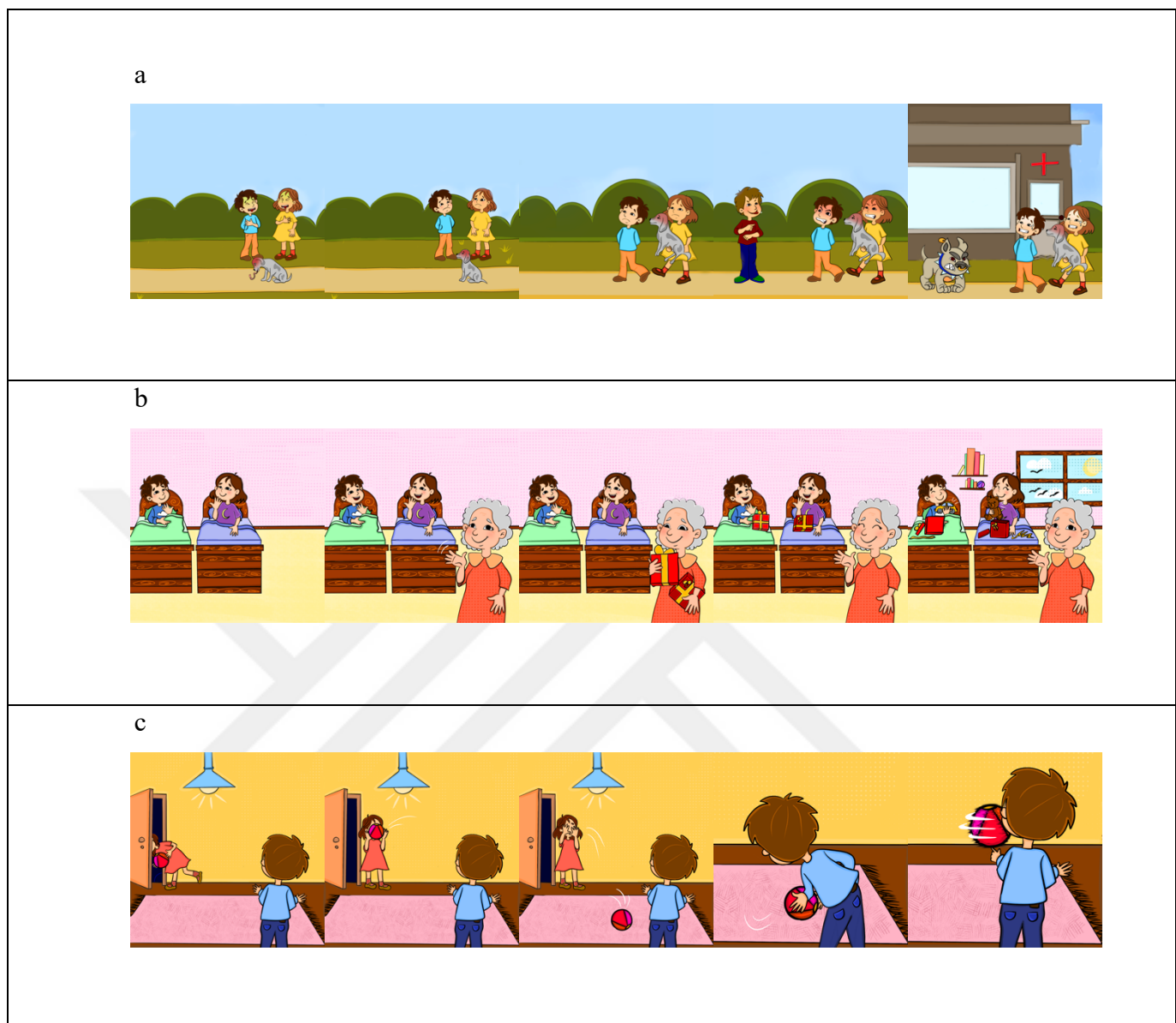


Figure 2.2: The displays of each emotion condition in the Emotion-Narrative Task (2.2.a.: Negative, 2.2.b.: Positive, and 2.2.c.: Neutral).

2.3 Procedure

Demographic information and consent forms were collected from the parents of participants via e-mail. All data from the children were collected in the kindergardens. For the experiment, children were first asked to complete the cartoon retelling task. A cartoon video was played on a computer screen. After that, they were asked to complete the Emotion-Matching Task (EMT) (Izard et al., 2003). There were four parts of the EMT: emotion expression matching, emotion situation knowledge, expressive emotion knowledge, and receptive emotion knowledge. There were two orders of EMTs. The

four parts were presented in the same order as listed above. However, there were 48 items and the order of the items was presented in two different orders. The EMT task was displayed in a computer screen. After that, children were asked to tell narratives in the emotion-narrative task. This task has three parts: Neutral, positive, and negative illustrative stories. Illustrative stories were presented in two orders. Every order starts with neutral story and the order of negative and positive stories are counterbalanced. To combine, 4 orders were presented in the study: EMT 1 vs EMT 2, and ENT 1 vs ENT 2. All of the tasks were video-recorded.

2.4 Coding

2.4.1 Linguistic Complexity Coding

Children's speech in the Cartoon-Retelling Task was coded as simple clauses and complex clauses. If a clause only consisted of one predicate, and described one event, it would be coded as single clause. If a clause consisted of more than one predicate and if two predicates were connected via conjunctions, relative clauses, adverbials, it would be coded as a complex clause (see Aktan-Erciyev, 2019; Berman & Slobin, 1994). The proportion of complex clauses to the total clauses was computed as the linguistic complexity score. All data were coded first by researcher and then 20% of the data were coded by a trained research assistant to conduct inter-rater analysis. There was a good reliability between the coders for complex clauses (ICC = .80) and for simple clauses (ICC = .91).

2.4.2 Emotional Language Coding

From the stories, children's speech was coded as *emotional utterances* (such as mad, happy, and sad) or *global quality* (such as simple Emotional Talk that did not contain emotion-situational talk, Complex Emotional Talk that contained emotion-situational talk) as coded in earlier work (Chan et al., 2023; Tao et al., 2013). Also, we coded emotional speech that does not accompany by gesture. The proportion of emotional utterances to the total utterances were calculated. All data were coded first by the researcher and then 20% of the data were coded by a trained research assistant to

conduct inter-rater analysis, which yielded a good reliability score for emotional talk (ICC = .93) and emotional-situational talk (ICC = .82)

2.4.3 *Gesture Coding*

The hand gestures used by the children during their stories were coded. For the total gesture count, we summed up children's use of gestures that described any event or object. Then, we coded gestures that accompanied by emotional talk or emotional-situational talk. We divided these gestures to the total utterances and used it as the dependent variable. All data was coded first by the researcher. For inter-rater analysis, 20% of the children's data were coded by another person. There was a good inter-rater reliability for detecting gestures in the videos (ICC = .95) and for gestures that accompany emotional speech (ICC = .93)

2.4.4 *Gesture Coding*

In the first part of the EMT (Expression-Matching knowledge) the answers were coded as 0 or 1. If children had chosen the right target, not any of the distractors, they obtained 1 point. In the second part of the EMT (emotion-situation knowledge), the answers were also coded as 0 or 1. In the third part of the EMT (expressive-emotion knowledge) children's answers were again coded as 0 or 1. When they saw a picture with a happy facial expression, and they expressed it verbally as "mutlu," "şen," or "neşeli" (Turkish translations for "happy"), they got 1 point, however, if they had answered the question as "iyi" or "güzel" (Turkish translations for "good" and "beautiful"), they obtained 0 point. In the fourth part of the EMT (receptive-emotion knowledge), the answers were coded as 0 or 1.

Chapter 3: RESULTS

3.1 Descriptive Statistics and Preliminary Analysis

3.1.1 Descriptive Statistics of Demographic Variables

The descriptive statistics of the demographic variables are presented in Table 3.1.

Table 3.1.

Descriptive Statistics of Demographic Variables

Variable Name	N	Min	Max	M	SD
Age	67	46.00	77.00	58.49	6.58
Linguistic Complexity	58	.00	.80	.229	.265
EMT	67	.29	.88	.669	.128
EMT-Matching	67	.25	.92	.687	.181
EMT-Situation	67	.25	.83	.561	.135
EMT-Expressive	67	.00	1.00	.617	.293
EMT-Receptive	67	.50	1.00	.815	.121

3.1.2 Descriptive Statistics of Emotion Narrative Task

The descriptive statistics of the variables that are coded in Emotion Narrative Task are presented in Table 3.2.

Table 3.2.*Descriptive Statistics of Demographic Variables*

Variable Name	N	Min	Max	M	SD
ENT- ES	64	.00	.25	.026	.042
ENT- GAES	64	.00	.51	.037	.070
ENT- ESS	64	.00	.02	.003	.005
NS- ES	65	.00	.67	.112	.667
NS- GAES	65	.00	.54	.064	.097
NS- ESS	65	.00	.08	.012	.019
PS- ES	64	.00	.90	.043	.130
PS- GAES	64	.00	.90	.034	.131
PS- ESS	64	.00	.07	.005	.013
NeutS- ES	65	.00	.21	.019	.037
NeutS- GAES	65	.00	.09	.007	.019
NeutS- ESS	65	.00	.07	.005	.015
ENT- Total Gesture	64	.00	.64	.145	.127
NS- Total Gesture	65	.00	.57	.134	.128
PS- Total Gesture	64	.00	.90	.156	.183
NeutS- Total Gesture	65	.00	.75	.154	.149

Note. ENT = Emotion Narrative Task; ES = Emotional Speech; GAES = Gesture accompanied by emotional speech; ESS = Emotional-Situational Speech; NS = Negative Story; PS = Positive Story; NeutS = Neutral Story

3.1.3 Preliminary Analysis

There were no significant differences between gender groups in the Emotion-Matching Task Scores, Emotional Narrative Task scores, and linguistic complexity scores (all $ps > .05$). We conducted correlational analyses to assess and prevent

multicollinearity of the variables. Correlations between variables are demonstrated in Table 3.3. There was no significant correlation between age, linguistic complexity score, emotional talk frequency, and multimodal emotional talk frequencies (all $ps > .05$).

Table 3.3

Correlations Among Covariates

Variable	1	2	3	4	5
1.Age	—				
2.Ling. Complexity	0.173	—			
3.ES	-0.087	-0.140	—		
4.GAES	0.016	-0.113	-0.172	—	
5.EMT	0.431***	-.000	0.092	0.219	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Ling. Complexity = Linguistic Complexity; ES = Emotional Speech; GAES = Gesture accompanied by Emotional Speech

We conducted a one-way ANOVA to see whether there was an effect of order of presentation of the tasks. There were four different orders. Two of the orders were created for the Emotion Matching Task (Izard et al., 2003) and two of the orders were created for the Emotion-Narrative Task. There were no significant differences between order groups in the aspects of emotional talk frequency, emotional-situational talk frequency, multimodal emotional talk frequency, and multimodal emotional-situational talk frequency (all $ps > .05$). Therefore, we did not include the order variable in our main analysis.

3.2 Main Analysis

For the (H1) hypothesis, results indicated that there was a positive relation between age and the total score of the Emotion Matching Task s , $r(65) = .43$, $p < .001$ (Table 3.4.). Older children performed better in the Emotion Matching Task. However, for the (H1a) hypothesis, there was no significant relation between age and subscore of Emotion Situation Knowledge, $r(65) = .239$, $p = .052$.

We next conducted a one-way repeated ANCOVA to see whether there were differences between Emotion-Matching Task subscores when we controlled children's

age. Results indicated significant differences among subscores of the Emotion-Matching Task, $F(3, 65) = 3.65, p < .05$, partial $\eta^2 = .053$. The Receptive-Emotion Knowledge was significantly higher than the other subtasks ($ps < .001$). The Emotion-Situation Knowledge was also significantly lower than the Expression-Matching Knowledge task ($p < .001$).

Table 3.4.

Corelation Among Emotion-Matching Task Scores and Age

	1	2	3	4	5	6
1.Age	—					
2.EMT	0.431***	—				
3.EMT1	0.339**	0.648***	—			
4.EMT2	0.239	0.568***	0.213	—		
5.EMT3	0.342**	0.832***	0.249*	0.338**	—	
6.EMT4	0.225	0.623***	0.411***	0.154	0.352**	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

To test (H2) hypothesis, paired samples t-test analyses was used. Results indicated that there was a significant difference between the neutral ($M = .02, SD = .037$) and negative ($M = .12, SD = .13$) stories in the aspects of children's emotion talk, $t(64) = 6.16, p < .001, d = 0.76$. Children also expressed more situations about emotions in their narratives in the negative story ($M = .12, SD = .13$) than the neutral story ($M = .12, SD = .13$), $t(64) = 2.17, p = .033, d = 0.27$. However, there was no significant difference between the positive story and the negative story in emotional talk and emotional-situational talk, $p > .05$.

For (H2a) hypothesis, paired samples t-test indicated that children used more gestures to accompany their emotional talk in the negative ($M = .64, SD = .097$) than in the neutral story ($M = .01, SD = .02$), $t(64) = 4.79, p < .001, d = 0.59$. However, there was no significant difference between positive story and neutral story in terms of gesture use that accompanied emotional talk, $p > .05$. For (H2b) hypothesis, paired

samples t-test indicated that there were no significant differences between negative and neutral story, and between positive and neutral story in terms of the total gesture use (all $ps > .05$).

For (H3) hypothesis, a hierarchical regression analysis was conducted to examine whether after controlling for age, gender, and linguistic complexity scores of children, variance in the total score of the Emotion-Matching Task would be explained better with multimodal emotional talk (speech + gesture) than only emotional talk. Age, gender, and linguistic complexity scores of children were entered in the first step. Emotional speech was entered in the second step, and multimodal emotional talk was entered in the third step. The first step was significant, $R^2 = .14$, $F(3, 52) = 2.79$, $p = .05$, explaining 14% of the variance in Emotion-Matching Task scores. Age significantly predicted Emotion-Matching scores, $\beta = .38$, $p < .05$. However, gender ($\beta = -.26$, $p = .330$) and linguistic complexity scores ($\beta = .03$, $p = .789$) did not significantly relate to Emotion-Matching Task scores. When we added emotional talk in the second step, it did not explain additional variance in the Emotion-Matching Task scores, $\Delta R^2 = .01$, $F(1, 51) = .57$, $p = .453$, and the step was not significant, $R^2 = .14$, $F(4, 51) = 2.22$, $p = .080$. Last, when we added gesture frequency that accompanied emotional talk to the third step, it did not explain additional variance in the Emotion-Matching Task scores, $\Delta R^2 = .06$, $F(1, 50) = 3.92$, $p = .053$. However, the step was significant, $R^2 = .21$, $F(5, 50) = 2.66$, $p = .033$. Gestures that accompanied emotional talk did not predict Emotion-Matching Task scores, $\beta = .26$, $p = .053$. Only the age remained as a significant predictor, $\beta = .43$, $p < .05$ (see Table 3.5.).

Table 3.5.

The Regression Model of Multimodal Emotional Talk Predicting the total Emotion-Matching

Predictors	<i>SE(B)</i>	β	<i>p</i>	R^2	ΔR^2	<i>F-change</i>
Step 1				.139		
Age	.002	.381	.006			
Gender	-.019	-.154	.564			
Ling. Complexity	.061	-.019	.885			
Step 2				.148	.009	.573
Age	.002	.393	.005			
Gender	.032	-.144	.592			
Ling. Complexity	.062	-.008	.949			
ES	.715	.099	.453			
Step 3				.210	.061	3.919
Age	.002	.427	.002			
Gender	.032	-.262	.330			
Ling. Complexity	.061	.035	.789			
ES	.712	.155	.242			
GAES	.224	.264	.052			

Note. Ling. Complexity = Linguistic Complexity; ES = Emotional Speech; GAES = Gesture accompanied by Emotional Speech

We then ran the same regression analysis for the subscores of the Emotion-Matching Task (Izard et al., 2003). In the first step, predictors were age, gender, and linguistic complexity. Emotional speech was entered in the second step and gesture frequency that accompanied by emotional speech was entered in the third step. For the Receptive-Emotion Knowledge subtask, regression analyses were not significant for any step (all $ps > .05$). Additionally, the second step did not explain additional variance in

the Receptive Emotion Knowledge, $\Delta R^2 = .02$, $F(1, 51) = .87$, $p = .355$. However, the third step explained additional variance in the Receptive Emotion Knowledge, $\Delta R^2 = .07$, $F(1, 50) = 4.05$, $p = .05$. Gestures that accompanied the emotional talk significantly predicted the Receptive Emotion Knowledge, $\beta = .29$, $p = .05$. Age, linguistic complexity and gender did not significantly predict Receptive-Emotion Knowledge (all $ps > .05$) (see Table 3.6.).

Table 3.6.

The Regression Model of Multimodal Emotional Talk Predicting Receptive-Emotion Scores

Predictors	<i>SE(B)</i>	β	<i>p</i>	R^2	ΔR^2	<i>F-change</i>
Step 1				.014		
Age	.002	.119	.402			
Gender	.033	-.027	.923			
Ling. Complexity	.062	-.053	.712			
Step 2				.031	.016	.873
Age	.002	.136	.346			
Gender	.033	-.013	.962			
Ling. Complexity	.063	-.038	.787			
ES	.725	.131	.355			
Step 3				.103	.072	4.051
Age	.002	.172	.223			
Gender	.033	-.141	.620			
Ling. Complexity	.062	.009	.949			
ES	.721	.191	.177			
GAES	.227	.285	.050			

Note. Ling. Complexity = Linguistic Complexity; ES = Emotional Speech; GAES = Gesture accompanied by Emotional Speech

For the Expressive-Emotion Knowledge Subtask, we ran a similar hierarchical regression. The regression analysis was not significant at any step and the second and the third steps did not explain any additional variance in the Expressive-Emotion Knowledge scores (all $ps > .05$). Only age was a significant predictor at first step ($\beta = .33, p < .05$) and remained significant at third step ($\beta = .36, p < .05$).

For hypothesis (H3b), hierarchical regression analysis was conducted to examine whether after controlling for age, gender, and linguistic complexity scores of children, overall gesture use predicted Emotion-Matching Task scores. In the first step, age, gender, and linguistic complexity scores were entered, and the gesture frequency was added in the second step. The first step was significant, $R^2 = .14, F(3, 52) = 2.79, p = .05$. The second step was not significant, and did not explain additional variance in the Emotion-Matching Task scores (all $ps > .05$). Except age, $\beta = .43, p = .003$, none of the predictors were significant (all $ps > .05$).

A hierarchical regression analysis was conducted to examine whether after controlling for age, gender, and linguistic complexity scores of children, variance in the total score of the Emotion-Matching Task would be explained better with multimodal emotional talk (speech + gesture) than only emotional talk in negative story condition. We added age, gender and linguistic complexity in the first step. In the second step, we added emotional speech in the negative story. In the third step we added gestures that accompany by emotional speech in the negative story. The steps were not significant and did not explain additional variance (all $ps > .05$). None of the variables significantly predict Emotion-Matching Task scores (all $ps > .05$).

Chapter 4: DISCUSSION

In this study, we examined the relation between multimodal emotional language and children's understanding of emotions. We assessed emotion understanding with a standardized Emotion-Matching Task (Izard et al., 2003) with four subtasks: Emotion-Matching, Emotion-Situation Knowledge, Expressive Emotion Knowledge, and Receptive Emotion Knowledge. We assessed children's multimodal emotional language with the Emotion-Narrative Task, in which children told stories about three different emotional situations (negative, positive, and neutral). Children's emotional speech and hand gestures that accompanied the emotional speech in the narratives were coded. We hypothesized that (H1) older children would perform better overall in the Emotion-Matching Task. (H2) There would be a significant difference in children's emotional talk and emotion-situational talk frequency between emotional stories and neutral stories, and (H2a) children would use more gestures to accompany the emotional talk in emotional stories than the neutral stories. Additionally, (H2b) there would be a significant difference of children's gesture use in the emotional stories than the neutral story. (H3) After controlling for age and language scores of children, variance in the emotion understanding would be explained better with multimodal emotional talk (speech + gesture) than only emotional talk. We also hypothesized that (H3a) children's emotion-situation knowledge would be explained better with multimodal emotional talk about situations (speech + gesture) than only emotional talk about situations.

First, supporting our (H1) hypothesis, we found a relation between age and Emotion-Matching Task scores. Older children performed better in the Emotion-Matching Task than younger children. This result is similar to the findings of Morgan et al. (2010) who assessed the validity of the original version of the Emotion-Matching Task in English-speaking 3- to 6- year-old children (Izard et al., 2003). They also found a significant correlation between age and the EMT total score. In another study that administered the Emotion-Matching Task to Spanish-speaking 3- to 6-year-old children, it was found that age was a significant predictor of the Emotion-Matching Task scores (Alonso-Alberca et al., 2012). Thus, our results are similar to the previous work tested in other cultures.

When we analyzed the subscores of the task, we only found correlations between age and Expressive Emotion Knowledge, and Expression Matching Knowledge. However, contradictory to our (H1a) hypothesis, there was no relation between age and Emotion-Situation Knowledge of children as well as their Receptive-Emotion Knowledge. These results may indicate the Emotion-Understanding developmental patterns. For instance, Emotion-Situation Knowledge has a protracted development, which would still be developing in 4- to 6-year-old children.

years (Denham, 1998). At the age of 4- to 6-year, children also start to evaluate the causes of events (Lohse et al., 2015). In addition, children may benefit from their causal understanding to assess emotions in context. That could be one reason of why emotion situation knowledge did not correlate with age. On the other hand, Receptive Emotion Knowledge is one of the first developing skills and it should already be developed in toddlerhood (Denham, 2003). As displayed in Table 1, the average score is high for our sample, which may suggest that most children have already developed an understanding of emotions.

Confirming our hypotheses (H2a) and (H2b), children's emotional talk and emotional situational talk, and their gesture use with their emotional talk were different in negative stories and neutral stories. Children used more emotional talk, emotional-situational talk, and multimodal emotional talk in their negative stories than neutral stories. However, we could not find a difference between positive stories and negative stories in any of these emotion expressions. Even though we conducted a pilot study with adults, and the results indicated that a positive story evoked emotional talk, children did not produce many emotion related words in describing the scenes for the positive story. This could be the consequence of the lower number of positive emotional words compared to negative story. Moreover, the negative story consisted of more different types of emotions than positive illustrative story. Thus, children produced more emotional words in the negative narratives than the positive ones. Emotional words produced by 4- to 6-year-old children include many negative ones (Grosse et al., 2021). Thus, limited availability of the positive emotional words in early childhood, the positive illustrative story contained limited number of positive emotional expressions. This could result in no difference in using emotion words between a positive story and a neutral story.

For our (H3) and (H3a) hypotheses, we found a role of multimodal emotional language in emotion understanding. Even though, multimodal emotional talk did not add additional variance to the Emotion-Matching Task score, when we controlled age, gender, and linguistic complexity of children, multimodal emotional talk predicted the Emotion Matching Task scores. We could not find the same result for emotional speech for any of the Emotion Matching Task subscores. Our results are similar to previous findings of Ornaghi and Grazzani (2013), which showed that the use of emotional-state talk did not predict emotion understanding, even though they were correlated. At first glance, our findings seemed to contradict research suggesting a link between specific emotion vocabulary knowledge and emotion understanding (Streubel et al., 2020). However, the assessment of emotion vocabulary was different in Streubel et al. (2020) and our aim was to examine emotional talk within a narrative, which would develop later.

When we analyzed each subtask of the Emotion-Matching Task as an outcome, we showed that multimodal talk predicted the emotion understanding only in the Receptive-Emotion Knowledge task. In fact, according to the (H3a) hypothesis, although we expected that gesture use would relate to emotional concepts that are acquired later, we could not confirm this hypothesis. The reason we expected this link was that development of many concepts are predicted by children's earlier gesture use (Goldin-Meadow, 2003). For example, gestures are predictive of the development of spatial concepts (Miller et al., 2020). In addition, people benefit from gestures for conceptualizing spatial-motoric information (Kita et al., 2017). For these reasons, we hypothesized that emotion-situation knowledge, which is expected to develop at the age of 4- to 6-year, would be predicted by gestures.

On the contrary to our hypothesis, the results showed that the early acquired emotion understanding skill was predicted by children's use of multimodal emotional language. As mentioned above, consistent with the previous findings (Morgan et al., 2010), children scored the highest in the Receptive-Emotion Knowledge of the Emotion-Matching Task. There was, however, no significant relation between age and Receptive-Emotion Knowledge Subtask. Thus, receptive-emotion knowledge could be already acquired at the age of 4- to 6-year. This finding suggested that gesture use is not only related to upcoming changes in concept development (Goldin-Meadow, 2009). Children can also express difficult and abstract concepts such as emotions with gestures

when they are in the early stages of acquiring these concepts. In other words, gestures can be also useful in emotion expressions when children have some knowledge about them. Another study demonstrated that infants' gesture use and joint attention were associated with their later receptive language. Children who used more gestures would have higher levels of joint attention, and thus receptive language skills could be explained by the relation between gesture use and joint attention (Salo et al., 2018). Therefore, children who use more gestures when they talk about emotions, may be more sensitive to understanding and receiving other's emotions, and also to understanding emotion concepts.

This study had some limitations. One of the limitations is that 10 of the children's stories could not be transcribed because either the audio was inaudible or the children did not want to participate in the story-telling part of the study. Therefore, one of the reasons that we could not find the effect of our covariates is the limited power of the study. Another limitation could be that participants did not produce expected level of emotional utterances or multimodal emotional talk in the positive emotional story. Thus, the stimuli seemed not to evoke emotionality in children like for adults. Therefore, the total emotional talk and gestures that accompanied by emotional talk was lower than expected.

Chapter 5: CONCLUSION

In conclusion, we asked whether children's multimodal emotional language was linked to their emotion understanding. We found that multimodal emotional talk was related to emotion understanding only in the receptive emotion knowledge subtask. However, we found that older children had higher emotion understanding than younger ones, particularly for expression-matching knowledge and expressive-emotion knowledge. In addition, children used more emotional talk and multimodal emotional talk in emotional stories rather than neutral stories. Last, children who used more gestures when they talked about emotions had higher level of receptive emotion knowledge than children who used fewer gestures. This study contributes to the field by explaining the role of hand gestures that are accompanied by emotional talk to conceptualize abstract concepts, such as emotions, and the role of emotion-specific language production in emotion understanding. Future studies should investigate the link between receptive emotion knowledge and multimodal emotional language with different variables, such as the attention level of children, and expressive and receptive language skills that are not specific to emotions.

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Appendix A: Emotion Narrative Task Coding

An example of emotional talk and gesture coding in Emotion Narrative Task is presented in the Figure A.1.

Transcription	Emotional Speech	Emotional Situational Speech	Gesture	Gesture accompanied by emotional speech	Gesture accompanied by emotional situational speech
Buradaki çocuk			1		
Burda köpek var			1		
Sonra hasta oluyor					
Orda da karnı ağrıyor					
Buradaki çocuk da ağlıyor	1		1	1	
Üzgün buradaki de	1		1	1	
Buradaki çocuk köpekten korkmuş	1	1	1	1	1
Korkup ona şaşırıyor	1	1	1	1	1
Burada da bu çocuğa dil çıkartıyor			1		

Figure A.1. An Example of Emotional Language and Gesture Coding in Emotion Narrative Task