THE EFFECT OF INHIBITORY CONTROL, WORKING MEMORY AND DOMAIN ON THE PROCESSING OF METAPHORS IN CHILDREN: A GESTURE-BASED STUDY WITH TURKISH SPEAKING PRESCHOOLERS.

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ABSTRACT

THE EFFECT OF INHIBITORY CONTROL, WORKING MEMORY AND DOMAIN ON THE PROCESSING OF METAPHORS IN CHILDREN: A GESTURE-BASED STUDY WITH TURKISH SPEAKING PRESCHOOLERS.

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The debate on how metaphors are processed has been a long-standing question, traditionally, divided into two opposing views: the indirect-access model and the direct-access model. Additionally, studies have shown that conventionality as well as inhibitory control (IC) and working memory (WM) play a crucial role in metaphor processing. To date, no studies have investigated the effect of IC and WM on the processing of metaphors in children. In light of these findings, we investigated how novel and conventional metaphorical motion events (MMEs) in two different domains (emotion and body) are processed by Turkish children (M_{Age}= 4,03; N = 20), and the effect of IC and WM on this process. In that regard, children were assessed through non-verbal gesture-based act-out task and verbal metaphor comprehension tasks. Children's responses were coded as metaphorical, literal, or null/wrong responses in both tasks. IC and WM were also assessed. A multinominal logistic regression was used to assess the effect of IC, WM, conventionality, and domain on the processing of MMEs. The results revealed that the better the IC, the higher the

probability of children using metaphorical gestures. Additionally, a higher WM capacity corresponded to more metaphorical verbal responses. Also, domain-specific differences were observed. The concrete metaphorical domain (body-domain) triggered the literal meaning of the vehicle, suggesting indirect processing, while abstract domain (emotion-domain) was directly interpreted metaphorically, without decomposition. The findings suggested that there is not one unified strategy to process metaphors and IC and WM play a significant role in metaphor processing in children.

Keywords: metaphor comprehension, inhibitory control, working memory, direct access model, indirect access model

ÖZ

ÇOCUKLARIN METAFORİK İFADELERİ ANLAMLANDIRMA SÜREÇLERİNDE KET VURMA YETİSİ, İŞLER BELEK VE ALAN ETKİSİ: TÜRKÇE KONUŞAN OKUL ÖNCESİ ÇOCUKLARLA JEST ODAKLI BİR ÇALIŞMA

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Metaforların nasıl işlendiği konusundaki çalışmalar, dolaylı erişim modeli ve doğrudan erişim modeli olmak üzere iki karşıt görüşe ayrılmıştır. Ayrıca, çalışmalar, metaforların aşinalık seviyelerinin yanı sıra ket vurma (KV) ve işler bellek (İB) yetilerinin metafor işlemesinde önemli bir rol oynadığını göstermiştir. Bugüne kadar, çocuklarda ket-vurma ve işler-belleğin metafor işlemesine etkisi araştırılmamıştır. Bu bulgular ışığında, bu çalışma, anadili Türkçe olan çocuklarda ($Yaş_{ortalama}$= 4,03; S = 20) yeni ve kalıplaşmış mecazi hareket olaylarının (MHO), duygu ve beden olmak üzere iki farklı alanda nasıl işlendiğini ve KV ile İB'nin bu süreç üzerindeki etkisi araştırmıştır. Bu bağlamda, çocukların metaforları anlama yetileri sözel olmayan jeste-dayalı ve sözel metafor açıklama aktiviteleri aracılığıyla değerlendirildi. Çocukların yanıtları, her iki görevde de, mecazi, gerçek anlam veya boş/yanlış yanıtlar olarak kodlandı. KV ve İB yetileri de değerlendirildi. Multinominal lojistik regresyon analizi, KV, İB, aşinalık değeri ve alanın MHO işleme üzerindeki etkisini

değerlendirmek için kullanıldı. Sonuçlar, KV'nin daha iyi olması durumunda, çocukların mecazi jestleri kullanma olasılığının daha yüksek olduğunu ortaya koydu. Ayrıca, daha yüksek bir İB kapasitesi, çocukların sözel metafor açıklama aktivitesinde daha çok metaforik cevap verme ihtimalini arttırdı. Ayrıca, metaforun alana-özgü farklılıklar gözlemlendi. Somut mecazi alan (beden alanı), kelimelerin gerçek anlamlarını tetikleyerek dolaylı erişim modeli gösterdi. Buna karşılık çocuklar soyut alan (duygu alanı) metaforlarını bileşenleri ayrıştırmadan doğrudan mecazi olarak yorumladı. Bulgular, metaforları işlemek için tek bir birleşik stratejinin olmadığını ve KV ile İB'nin çocuklarda metafor işlemesinde önemli bir rol oynadığını öne sürdü.

Anahtar Kelimeler: Metafor işleme süreçleri, ket vurma yetisi, İşler belek, direkt erişim modeli, dolaylı erişim modeli

In memory of Ekin Hüzmeli and Mira Hüzmeli

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IC : Inhibitory control

MMEs : Metaphorical motion events

WM : Working memory

CHAPTER 1

INTRODUCTION

Metaphors are frequently used in daily language, appearing approximately once in every third sentence in general-domain texts (Cameron 2003; Martin 2006; Shutova & Teufel 2010). Metaphors, such as *the life is a highway*, state that two things, namely the vehicle (e.g., highway) and the topic (e.g., the life) share something in common, implicitly. Therefore, listeners are expected to comprehend the intended meaning hidden between the lines instead of processing metaphors literally. Humans can process such symbolic use of language in milliseconds.

Considering the frequent appearance of metaphors in daily language, it is obvious that lack of the ability to understand such utterances can cause societal and educational problems for individuals. Although many attempts have been made to understand how people process metaphors and the factors that affect this ability, these issues have not yet been solved clearly, due to opposite arguments and findings in the literature (Öztürk et al., 2020). Furthermore, studies mainly approach this issue from a processing, developmental, or cognitive point of view.

Firstly, studies investigating how people process metaphors are, traditionally, divided into two main views, direct and indirect access models. The indirect-access model suggests listeners initially impose literal meaning (decomposition), and then seek for metaphorical interpretation when literal meaning fails (Davidson, 1978; Gertner & Bowdle; 2008; Grice, 1975; Searle, 1979). Conversely, the direct-access model proposes that metaphors are directly interpreted without decomposition as separately stored lexical items (Glucksberg, 2008; Glucksberg & Keysar, 1990; Gibbs, 1994; McElree & Nordlie, 1999; Wolff & Gentner, 2000).

Secondly, studies investigating when this ability emerges argue that this ability emerges not until 8-10 years old (Asch & Nerlove, 1960; Cometa & Eson, 1978; Elkind, 1969) while some others using more child-friendly methods proposed children can understand such utterances even at the age 4-5 (Hülagü & Özge, 2017; Özçalışkan, 2007; Pouscoulous & Tomosello, 2020).

Thirdly, some studies revealed that conventionality of the metaphor (i.e., *whether or not it is familiar*) has an effect on the processing of the metaphors. The more familiar a metaphor is, the easier it is to process (Glucksberg & Keysar, 1990; Giora, 1997).
Lastly, some studies focusing on cognitive factors revealed that inhibitory control and working memory might play a role in the processing of metaphorical meaning. Inhibitory control, which is a cognitive function allowing us to suppress impulsive thoughts and behavior, seems to have a significant role in this process (Carriedo et al., 2016; Chiappe & Chiappe, 2007; Pierce & Chiappe, 2008). To understand the intended meaning of the utterances, individuals should suppress the literal meaning of the words to create maps between the vehicle and the topic, which requires inhibitory control. To create a map between the vehicle and the topic, listeners should also manipulate the possible meaning and features the vehicle has that can match with the topic in the metaphorical expression. In that step, working memory, which is a cognitive system allowing the retrieval and manipulation of the information while performing a cognitive task, plays a role in retrieving information regarding their possible meanings and features that can match with the topic (Carriedo et al., 2016; Chiappe & Chiappe, 2007; Mashal, 2013). Some studies also presented findings that individuals with cognitive function deficit performed poorer in metaphor comprehension tasks compared to their healthy peers (Chouinard & Cummine, 2016; Deamer et al., 2019; Gold et al., 2010; Monetta & Pell; 2007). It is worth noting that none of these studies were conducted with preschool age children, but they rather focused on adult participants.

While most of the above-mentioned studies aimed at analyzing metaphor processing in English, there are many studies conducted on metaphors also in Turkish. Most of the studies conducted in Turkish in this field focused on the theoretical aspects of the

figurative language and compared Turkish metaphors with their counterparts in English (Aksan, 2006; Aksan & Kantar, 2008; Arıca-Akkök, 2017) while some studies employed methods of corpus linguistics to analyze metaphors in Turkish (Aksan & Aksan, 2012; Efeoğlu & Işık-Güler, 2017). In addition to theoretical and corpus-based studies, some other papers employed psycholinguistics methods such as eye-movement (Arıca-Akkök & Uzun, 2018), and self-paced reading paradigm (Özkan et al., 2020) to investigate adult processing of Turkish metaphors with different familiarity levels. However, there are not any studies investigating how factors such as cognitive abilities, age, domain, and familiarity interact during the course of metaphor interpretation in Turkish.

All above mentioned studies approached the issue from a different aspect, revealing remarkable findings. It can be concluded that there are many factors affecting the process of metaphor comprehension. However, it is important to combine these approaches together to reveal the interaction between these factors to shed light on the issue. It is also crucial to investigate metaphors in different languages, and with different populations to have a better understanding of the nature of metaphors across languages to provide more experimental data that could inform the theory of metaphor processing. Therefore, this study aims to use a child-friendly gesture-based act out study to investigate how Turkish speaking preschool children process familiar, unfamiliar and novel metaphors in two different target domains (emotion and body) and how this process is affected by inhibitory control and working memory. Data presented in this thesis is of significance in that it focuses on the process of metaphor comprehension in Turkish speaking preschool children, and the effect of their cognitive abilities on this process, which is new in the literature.

The findings will provide a new perspective and practical implications for the theoretical problems of various fields, including experimental linguistics, language development, psycholinguistics, and cognitive sciences, as well as developmental and cognitive psychology, preschool education, and primary education.

In the present chapter, the aims and the significance of the present study have been introduced. In the second chapter, the literature review focusing on the direct and

indirect access to metaphorical meaning, metaphor comprehension in early childhood and linguistics factors, namely, domain (emotion and body) and familiarity (familiar, unfamiliar and novel metaphors) as well as cognitive factors (inhibitory control and working memory) will be covered along with their link with metaphor comprehension process. The chapter will end with the aim of the present study and research questions. In the third chapter, the methodology of the current study will be explained in detail with the description of the sample and the tasks.

CHAPTER 2

LİTERATURE REVIEW

This chapter aims to introduce the major theories of metaphor processing, metaphor comprehension in early childhood, cognitive and linguistics factors influencing comprehension of metaphors. The factors and the relationship between these variables and metaphor comprehension in childhood were discussed in light of the previous research conducted in this field. The aim of the present study and research questions are stated at the end of this chapter.

2.1. Major Theories of Metaphor Processing

The debate on how figurative use of language is processed has been traditionally divided into two opposing views, namely, the indirect and direct access model of metaphorical meaning. These models are explained in view of related studies in the next subsections.

2.1.1. Indirect Access Model of Metaphorical Meaning

The indirect access model emerged from Grice's (1975) and Searle's (1979) accounts for metaphors. Grice (1975) proposed that metaphors violate the conversational maxim of quality, and this leads listeners to understand the intended meaning is not directly what the speaker says. Thus, they seek for the other possible meanings. Searle (1979), similarly, on his speech act theory, investigated how metaphors work and how speakers possibly communicate with listeners when speaking metaphorically. Since the intent behind the speakers' utterances is different from what they say, Searle (1979) named metaphors as indirect speech acts. In other

words, when a speaker says S is R metaphorically, they mean S is P. According to this account, what the speaker says (S is R) is *a sentence meaning* while what the speaker means (S is P) is *the speaker's utterance meaning.* Searle discussed, thus, there should be systematic principles or strategies to arrive from the sentence meaning to the utterance meaning. At that point, Searle suggested that to understand the figurative meaning intended by the speaker, listeners first impose the literal meaning (i.e., *decompose the term into the literal meaning of each lexical item; henceforth: decomposition*) and realize the utterance does not make sense or is false when taken literally. Then, they seek for the possible metaphorical meaning of the utterance. Following Searle's account, some experimental studies also revealed results that align with the indirect access of metaphorical meaning (Weiland et al., 2014). In a study, Janus and Bever (1985) investigated the reading time required for literal and metaphorical utterances. Participants were required to read passages followed by a target sentence that could be taken literally or metaphorically depending on the passage they had read, as in (1) (p. 481):

(1).

> a. Lucy and Phil needed a marriage counselor. They had once been very happy, but after several years of marriage, they had become discontented with one another. Little habits, which had at first endearing, were now irritating and caused many senseless and heated arguments.
>
> b. The old couch needed re-upholstering. After two generations of wear, the edges of the couch were tattered and soiled. Several buttons were missing and the materials around the seams was beginning to unravel. The upholstery had become very shabby.

After each of these passages, the participants were shown the following sentence: "the fabric had begun to fray". This sentence should be taken metaphorically following the first passage while it has literal meaning when it follows the second passage. The findings were in line with the indirect access model of metaphorical meaning. The result revealed that metaphorical target sentences required more reading times relative to literal target phrases suggesting that participants take a longer time to decompose the literal meaning of the metaphorical target sentences and then seek possible metaphorical meanings.

This view, therefore, suggests that non-literal meanings are initially interpreted literally. However, the direct access model of metaphorical meaning has been against this assumption (Giora, 1997; Gibbs, 2002). In the next subsection, the direct access model of metaphorical meaning is presented.

2.1.2. Direct Access Model of Metaphorical Meaning

The direct access model of metaphorical meaning rejects the view that literal meaning is accessed first when a speaker's utterance is metaphorical. Rather, this view suggests that there is no need for the decomposition to interpret the metaphorical meaning (Glucksberg & Keysar, 1990; Gibbs, 1994b; Wolff & Gentner, 2000). Glucksberg (2008) proposed that metaphor understanding is based on dual reference. For instance, for the sentence "A lawyer is a shark", the literal meaning is falsified only when the word "shark" is taken to refer to a marine creature. However, this word can also refer to the category of predatory and aggressive creatures. Therefore, the word "shark", just as other metaphorical vehicles, has dual reference. Thus, listeners can directly achieve the metaphorical meaning of this utterance without initially falsifying the literal meaning. In that regard, the direct access model proposed that listeners do not need to take longer to comprehend metaphors since both literal and metaphorical meanings are interpreted through the same process. Some experimental studies also revealed supporting results for this view. In a study, McElree and Nordlie (1999) examined the reading time required to judge metaphorical and literal sentences. For each sentence pair, the utterance ended with the same word, either with metaphorical (e.g., *some hearts are stone*) or literal (e.g., *some temples are stone*) use. The participants were asked to judge whether these sentences were literally true. There was no significant time difference in understanding literal and metaphorical utterances. Participants computed both types of interpretation in equal time, which supports the direct access model. Recently, Patalas and de Almeida (2019) used an online cross-modal priming task, by which participants listen to a sentence, and simultaneously see a picture on the screen and conduct a lexical decision task based on a target question (e.g., *pressing "no" if the target is not a word, "yes" otherwise*). By using this task, they

presented metaphors and similes in the form of “X is Y” and “X is like Y”. All the sentences were presented in a context. Immediately after listening to the sentences, participants made decisions for comprehension questions related to target sentences. The result revealed no significant reaction time difference in the understanding of metaphors and similes. This finding was proposed to support the direct access model, since similes should have been processed faster considering the indirect access model.

To find an answer for how metaphors are processed, many experimental studies have been conducted and revealed contradictory results supporting either the direct-access model or the indirect-access model. However, many other factors including age have also an effect on metaphor comprehension. The next section will present studies focused on metaphor comprehension in early childhood.

2.2. Metaphor Comprehension in Early Childhood

Pragmatics has a significant role in the development of children’s communicative skills (Tomosello, 2008), and early in their life, children tend to form analogies between objects while discovering their environments. For example, a 26-months old child said “corn, corn” while pointing to a yellow baseball hat, and an 18-months old child called a toy car as a snake while twisting it up to his mother’s arm (Winner et al., 1979). Although previous studies mentioned such cases where children in early ages uttered metaphor-like sentences (Piaget, 1962; Werner & Kaplan, 1967), these utterances were not analyzed as genuine metaphors but as overextension or pretense by many scholars. To investigate the development of metaphor understanding in children, many studies have been conducted in the 60s and 70s. These studies investigating metaphor comprehension in childhood suggested that metaphor comprehension develops in late childhood and children interpret metaphors literally until the age of 8-9 (Asch & Nerlove, 1960; Cometa & Eson, 1978; Elkind, 1969). In a study, Billow (1975) investigated metaphor comprehension of 50 children at the age of 5 to 14 years old. They were presented with two example sentences including metaphors with their interpretations prior to the experiment. Then, each of the

participants was asked to give an interpretation for given metaphorical expressions in the form of X is Y (e.g., *a butterfly is a flying rainbow*). After that, the experimenter showed pictorial representations of the same sentences and explained the correct meaning of the expressions. The participants, then, were asked four questions related to the vehicle and the topic. For example, for the sentence *a butterfly is a flying rainbow*, the children were asked if there are more colorful things and more butterflies in the world. When the child gave an example, they were asked why and required to explain their answers in more detail. The results revealed that 9-year-olds and older participants were significantly better in metaphor interpretation and that understanding metaphors occurs later in childhood. Similarly, Winner and colleagues (1976) recruited 180 children at the ages of 6 to 14 in the study. Participants were told a story including metaphorical expressions (e.g., *after many years of working at the jail, the prison guard had become a hard rock that could not be moved*) and were asked to orally explain what these sentences mean. The responses were coded as either magical, metonymic, primitive metaphoric, or genuine metaphoric. The results were parallel with previous findings that children younger than the age of 8 could not give genuine metaphorical explanations and children at the age of 5 uttered more magical explanations for the expressions as if they happened in a magical world.

However, methodologically, these studies were reviewed by some scholars (Vosniadou & Ortony 1983; Pouscoulous, 2011). It was suggested that the experimental paradigms in these studies require high metalinguistics demand especially for younger children, by asking them to verbally explain the meaning of the metaphors and give a verbal justification of the vehicle and the topic used in the metaphorical expression. These tasks may place high demands on children which prevents the evaluation of their pragmatics skills. In that regard, some studies aiming to reduce metalinguistics demand by using a more child-friendly paradigm revealed that children do understand metaphors at earlier ages than it was traditionally thought, albeit with some limitations (Özçaliskan, 2007; Pearson, 1990; Waggoner & Palermo, 1989). Pouscoulous and Tomosello (2020), for example, investigated the metaphor comprehension ability of 3-year-olds by using a game. In the study, children were required to choose one of the two objects referred to by a metaphorical

expression by the experimenter. For instance, a tower with the hat was a metaphorical expression used in the experiment. The correct choice for this expression would be a tower toy with a pointy roof while the wrong answer was a tower with a balcony. They noted that 3 years was the youngest age for children to be expected to understand metaphors since they start to acquire the literal meaning of a stock of vocabulary at that age. To understand the metaphors, children should have access to the literal meaning of the words used in the expression. The results revealed that children, at the age of 3, showed an understanding of metaphorical use in the given expressions. However, the metaphors used in the study are controversial in that the items were formed in terms of similar features of the topic and the object, such as using the word "*hat*" to refer to the roof of the tower. Children have the ability to understand and form analogies based on featural appearances in a very early age (Winner et al., 1979). However, it is still an unresolved question if they can also understand abstract and concrete metaphors that do not have an implicit featural similarities between the vehicle and referent.

Özçalışkan (2005), similarly, examined the comprehension of high and low frequent metaphorical motion events by children at the age of 3 to 5 years old. Children were told a story including metaphorical motion events in different domains including time, idea, and body domains. They were, then, introduced with two puppets that would help them to answer questions related to the story accompanied with pictorial representation of it. Then, each child was required to retell the story by looking at the picture. To test their understanding of the story, the experimenter asked comprehension questions following the two answers given by the puppets. The children were asked to decide which puppet gave the correct answer. The stories were designed in a way that the children had to understand metaphors in the story to detect the correct answer. After that, each child was interviewed for the literal and metaphorical meaning of the target domain. The results revealed that at the age of 3, children do not fully understand metaphorical motion events, at the age of 4, children can interpret metaphors given in a story context, and at the age of 5, they can give verbal explanations to the metaphorical motion events. Özçalışkan (2007) further conducted a cross-linguistics study to analyze the comprehension of metaphorical

motion events by Turkish and English preschoolers at the age of 4 to 5 years old. In addition to the method and procedure used in Özçalışkan's (2005) experiment, in the interview part, children were presented with pictures demonstrating the literal meaning of the motion verbs (e.g., *a bird flying*), assuming children mostly focused on the literal meaning of the source domain (i.e., *vehicle*) to interpret metaphorical motion events. Following the picture presentation, children were asked to describe the picture. After that, the experiment asked some questions about the metaphorical extension of the motion verb related to the story told (e.g., *can time fly?*). The findings revealed that both native Turkish and English-speaking children at age 4 could understand metaphors when presented in the story. However, the same children gave mostly physical descriptions accompanied with gestures for metaphorical events when the questions about the metaphorical extension of the motion verb were asked in isolation, without context. However, a significant improvement in metaphor comprehension was observed at age 5. While 4-year-old children focused mainly on the source domain of the metaphorical events to interpret the metaphors, 5-year-old children could consider both the literal and metaphorical meaning of the motion verbs. Also, for this age group, gestures evolved to metaphorical hand gestures from physical whole-body gestures. These results revealed that children at the age of 5 could understand metaphors. However, to what extent 4-year-old children can understand metaphors is still an unresolved question.

In another study, Hülagü and Özge (2017) also tested the comprehension of metaphorical motion events by children at the age of 4 in the frame of direct and indirect access models proposed to account for adults' processing of metaphors. Different from, Özçalışkan (2005), they asked children to describe the motion events in gestures (e.g., *run into frustration*). They revealed that children can understand metaphors. Also, children showed a tendency to decompose when the expression was unknown to them. However, if the metaphor was a part of their lexicon, they had direct access to the meaning at the age of 4. However, the metaphors used in the study were not classified according to their domains as in Özçalışkan's (2005) study. Using domain-specific metaphors can give an insight into how metaphors are processed.

In the light of these results, children, when child-friendly experimental paradigms are used can understand metaphors, and it is a domain-general skills that developed at early ages. However, there is a need to explore the effect of different types of domains on metaphor processing to have a better understanding of this process. Furthermore, there are also linguistics and cognitive factors that affect the ability of metaphor comprehension. The following subsections present findings from studies investigating the effect of these factors.

2.3. Factors Influencing Metaphor Comprehension

There are many studies conducted regarding the factors influencing the process of metaphor comprehension, suggesting both linguistics and individual differences play a role in metaphor comprehension (Cain et al., 2005; Chiappe, 2003; Gagné, 2002; Jones & Estes, 2006; Norbury, 2004; Stamenković & Holyoak, 2018). These studies revealed findings suggesting that conventionality and cognitive abilities including inhibitory control and working memory play a crucial role in metaphor comprehension. Studies investigating the role of these factors in metaphor processing are presented in the next subsections.

2.3.1. Conventionality and Novelty in Metaphor Comprehension

Conventionality of a metaphor refers to the strength of the association between the literal meaning and figurative properties of a vehicle. For instance, *river*, as a vehicle, is strongly associated with its figurative property referring to anything that flows forward (e.g., *time is a river*). However, by using *river* as a vehicle many different metaphorical expressions can be uttered, and how frequently these utterances appear in daily conversation may vary. For example, the metaphorical expression *time is a river* is frequently used in daily language; therefore, it is a familiar metaphorical sentence. However, the expression *consciousness is a river* is an unfamiliar metaphor since it is not used very frequently.

Novel metaphors, on the other hand, refer to the expressions that do not have a part of the conventional way of mapping and where the vehicle of a metaphor is newly

coined. For example, *theories are fathers* can be used as a novel metaphor that requires a newly established mapping between the vehicle and the topic.

Studies on pragmatics question whether there is an effect of conventionality and novelty in metaphor comprehension. According to Giora's dual access theory (1997), familiar metaphors are processed directly as separate lexical items, and their metaphorical interpretations are stored in memory. However, unfamiliar metaphors are not directly accessed; rather they initially trigger the literal meaning (Glucksberg & Keysar, 1990; Griora, 1997). To investigate this issue, Giora and Fain (1999) conducted a word fragment completion test to check the activation of literal and metaphorical meaning in literally and figuratively biased contexts. For familiar metaphors, the access to both literal and metaphorical meaning would be simultaneous regardless of context. For less familiar metaphors, on the other hand, they would initially activate the literal meaning of the sentence in both types of contexts. For example, for the expression, *their bone density is not like ours,* participants would first think of the literal meaning of the expression, and then arrive at the metaphorical meaning in a figuratively biased context. However, the same expression would not evoke metaphorical meaning in a literally biased context as in (2a) and (2b) (p. 1603).

(2)

> a: My husband is terribly annoyed by his new boss. Every day he comes home even more depressed than he had been the day before. Somehow, he cannot adjust himself to the new situation. Their bone density is not like ours.
>
> b: Our granny had a fracture from just falling off a chair and was rushed to the hospital. I told my sister I never had fractions falling off a chair. She explained to me about elders. She said: Their bone density is not like ours.

The result was as they predicted. The metaphorical meaning of familiar metaphors was activated even in literally biased contexts; however, it was not the case for less-familiar expressions in the same type of contexts, showing that familiar metaphors are directly processed while unfamiliar ones do not.

In another study, Arıca-Akkök and Uzun (2018) aimed to investigate differences between cognitive reactions in online processing of metaphoric sentences with high

and low familiarity levels by using an eye-movement paradigm. The experiment consisted of Turkish metaphors in the X is Y form followed by a context sentence (*e.g., Father is a beautiful tree, and it usually has solid roots.*) as well as literal sentences. The familiarity of metaphors was rated by native Turkish speakers based on their familiarity levels, prior to the experiment. Participants were asked to judge whether the sentences were acceptable. The results showed that participants required more time to make a judgment for unfamiliar metaphors compared to familiar ones, suggesting that familiar metaphors are easier to process when compared to the ones with low familiarity. The study also added support to the indirect access model, revealing that metaphorical sentences required more time to judge compared to literal ones.

Further, Gentner and Bowdle (2001) and Bowdle and Gentner (2005) suggested in the Career of Metaphor model that there is also a difference in the processing of novel and conventional metaphors regardless of familiarity. Novel metaphors, according to this model, should be cognitively more demanding to interpret compared to conventional ones, since they require comparing the concepts to discover a plausible mapping between the topic and the vehicle on-line. In a study, Lai and colleagues (2009) conducted an event-related potential study to investigate the difference between the processing of novel and conventional metaphors. In a sensicality judgment task, they used the same word to end anomalous, novel metaphorical, conventional metaphorical, and literal sentences. The novel metaphors as well as anomalous sentences elicited more negative N400 amplitude compared to literal and conventional sentences. It was suggested that novel metaphors require higher cognitive demand and are more difficult to interpret.

Recently, Özkan and colleagues (2020) conducted a self-paced reading study to investigate whether there is a difference in the processing of novel and conventional metaphors in native speakers (L1 group) and second language speakers (L2 group) in Turkish. The experimental items included literal sentences, familiar and novel metaphorical sentences, and semantically anomalous sentences. Participants were presented with each sentence and were asked to make a judgment based on the

sentences' meaningfulness. Regardless of the language group, novel metaphors and semantically anomalous sentences required longer time to process compared to literal sentences and familiar metaphors. It was suggested that novel metaphors required higher cognitive demand on readers since a novel mapping was created. Moreover, since no significant time difference was observed in the processing of familiar metaphorical and literal sentences, the findings supported direct access model for both language groups.

In the next section, the effect of cognitive functions including inhibitory control and working memory in metaphor comprehension will be presented in the light of previous studies.

2.3.2. Inhibitory Control and Metaphor Comprehension

Inhibitory control is a cognitive function that helps control one's attention and impulsive behavior or thoughts so as to do what is required by suppressing the goal-irrelevant stimuli (Diamond, 2013). Understanding the implicated meaning of a metaphor requires filtering out the metaphor-irrelevant information as well as the literal meaning of the words, which requires inhibitory control. In other words, frequently used meanings are inhibited while semantically proper meanings and features are selected (Gernsbacher et al., 2001; Giora, 1997; Glucksberg et al., 2001; McGlone & Manfredi, 2001). Giora (1997) in their dual access theory, suggests that more salient meanings should be suppressed so as to arrive at the intended metaphorical meaning. For example, to say *one is flying high* should not be taken to mean that he or she is literally flying or has wings. To this end, being able to suppress the literal meaning of the words and metaphor-irrelevant information requires inhibitory control (Giora, 1997; Lakoff & Johnson, 2008). Considering that especially novel metaphors require a greater processing cost compared to conventional and more familiar ones (Arzouan et al., 2009; Bowdle & Gentner, 2005; Lai & Curran, 2013; Lai et al., 2009) since there is no available figurative meaning for the vehicle of metaphor, inhibitory control seems to be essential to infer the possible meanings by computing relations between a novel vehicle and a topic. In

other words, inhibitory control is needed to select possible meanings by suppressing the more frequently used alternate or literal meanings of the vehicle. In that regard, some research revealed results concerning the importance of inhibitory control in the process of metaphor comprehension, especially of the novel and less familiar ones (Menashe et al., 2020; Deamer et al., 2019). Sana and colleagues (2021) conducted a study to examine the interplay between inhibitory control and metaphor comprehension. Adult participants took a modified Erikson Flanker test for the evaluation of inhibitory control and a sense-nonsense task for the assessment of metaphor comprehension. The sense-nonsense task consisted of both conventional and novel metaphors decided according to a pilot study where native speakers had rated given metaphorical phrases (X is Y form) depending on their conventionality and novelty. The results revealed that individuals with high inhibitory control were faster at responding to the novel metaphors compared to those with lower inhibition control.

Moreover, there are some studies showing that the involvement of inhibitory control is not limited only to the processing of novel metaphors (Carriedo et al., 2016; Chiappe & Chiappe, 2007). Individuals with better inhibitory control performed better in metaphor comprehension tasks irrespective of the metaphor type, compared to those with lower inhibition control. In a study, Yoon and colleagues (2021) conducted a study to investigate which of the executive functions mostly intervene metaphor comprehension. The metaphor comprehension task included metaphorical sentences in the form of X is Y (i.e., *He is glue*), given in context. The metaphorical sentences were either a good match or irrelevant to the context sentence. Adult participants were required to judge the metaphorical sentences as to whether or not they are a good match with the context given. The result indicated that participants with better inhibitory control performed better in the judgment of the metaphorical sentences. Similarly, Chiappe and Chiappe (2007) investigated the link between the adult's performance on the inhibitory control and metaphor comprehension tasks. Participants were required to interpret the meaning of metaphors all of which were presented in the form of X is Y (*i.e., Dancers are butterflies*). The results were parallel with the authors' hypothesis, as participants

with better performance in a Stroop task constructed more qualified interpretations and were faster at it compared to those who displayed lower performance in the Stroop task. Similar results were found in a recent study conducted with young adults (Sana et al., 2021). A sense-nonsense task as well as a flanker task to assess inhibitory control were administered. In the sense-nonsense task, participants were asked to decide whether given literal and metaphorical sentences had sensible meaning. The results were parallel with previous findings. Participants with better performance in the flanker task responded faster during the sense-nonsense task.

There are also many studies focusing on metaphor comprehension of individuals with some impairments which are known to lead deficit in inhibitory control, namely; schizophrenia (Deamer et al., 2019; Mo et al., 2008; Rossetti et al., 2018), Alzeimer's disease (Amanzio et al., 2008; Papagno et al., 2003), Asperger Syndrome (Gold et al., 2010; Herman et al., 2013), and Autism (Chouinard & Cummine, 2016; Melogno et al., 2017; Rundblad & Annaz, 2010).These studies including a healthy control group revealed a significant difference between the groups showing that the healthy control group outperformed the experimental group in the tasks required metaphor comprehension. Although the studies conducted with individuals diagnosed with diseases associated with inhibitory control deficit revealed clues for the role of inhibitory control in the process, none of these studies explicitly assessed the performance of the participants in an inhibitory control task. Rather, the conclusion was made on the basis of previous studies indicating an association between inhibitory control and metaphor comprehension.

Besides the aforementioned diseases, aging is another reason causing a decline in cognitive abilities (Hasher & Zacks, 1988; Park et al., 2002). Therefore, it might as well have an impact on the pragmatic inference-making of older aging adults. Many studies conducted with older adults showed that aging older adults' metaphor comprehension is intact (Newsome & Glucksberg, 2002; Sundaray et al., 2018). However, a decline in cognitive abilities requires much more effort to comprehend metaphors, thus, leading to more time being spent to understand metaphors (Morrone et al.,2010). Morrone and colleagues (2010) investigated the impact of advancing age

on inhibitory control and metaphor comprehension. 30 younger adults (age range: 21-30) and 30 older adults (age range: 65-75) participated in the study. The metaphor task consisted of literal, metaphorical, and anomalous expressions. Participants were required to accept only literal expressions by pressing a specific key on the keyboard. The result demonstrated that aging older adults took more time to reject metaphorical expressions compared to young adults. This suggested that, although the ability to understand metaphors is intact in older adults, a decline in inhibitory capacity affects the response time of judgment.

All of the abovementioned studies were conducted with adults or older adults and there are few studies that focused on younger age groups' ability to interpret metaphors and its relationship with executive functions, specifically with inhibition control. Carriedo and colleagues (2016) investigated the relationship between executive functions and metaphors in three different age groups, namely, 11 years old group, 15 years old group and young adults between the ages of 21-25. Participants were required to interpret given metaphorical sentences. The results revealed that inhibitory control was a good predictor for the performance in the metaphor comprehension task by the age of 15. However, neither working memory nor inhibitory control showed a significant correlation with metaphor comprehension ability at the age of 11.

To the best of our knowledge, there is no study investigating the relationship between inhibitory control and metaphor comprehension in earlier ages. Considering the results revealed by the previous studies in the literature, it is plausible to hypothesize that inhibitory control may play a crucial role in metaphor comprehension across ages. Further studies are needed to close this gap in the related literature.

2.3.3. Working Memory and Metaphor Comprehension

As mentioned by Kintsch's (2000) computational model of metaphor comprehension, the representation of words' meaning is computed to select the

contextually proper interpretation of metaphors by inhibiting other meanings that do not apply to the topic. In other words, to understand the intended meaning of a metaphorical expression, it is not solely enough to suppress the literal meaning of the words used in the expression. Possible properties associated with the vehicle which are not applicable to the topic should be inhibited as well. In this stage, working memory, which is a cognitive system that allows retrieving information for a short period of time while performing a mental task on that information (Diamond, 2013), is considered to have a significant role in interpreting metaphors (Carriedo et al., 2016; Kazmerski et al., 2003; Pierce et al., 2010).

One of the preliminary studies investigating the role of working memory in metaphor comprehension was conducted by Blasko (1999). In the study, the Reading Span task was used to assess adult participants' working memory capacity. According to their score, they were classified as a high and low working memory span group. Then, they were asked to both generate interpretations for metaphorical expressions in the form of X is Y (e.g., *a mosquito is a vampire*) and rate them according to their familiarity, aptness, and ease of interpretation. Although there was not a significant difference between the span groups on the three-rating scales, the groups differed in the quality and depth of interpretation. For instance, for the metaphor *thought is a snake sliding and coiling on warming stones*, an individual with a high working memory span gave the following interpretation: "the snakes move like the neural messages in the cortex during the thought process. The thought processes warm and activate the brain like the stones warm the snake". The explanation of the same metaphor by a low working memory span individual, on the other hand, was as follows: "Thoughts are constantly moving". The study, hence, proposed that individuals with a high working memory span generated more quality interpretation focusing on more than a single surface feature. Kazmerski and colleagues (2003) found quite similar results to those of Blasko (1999). The higher the working span an individual has, the more quality and complete interpretation they give.

In another study, Pierce et al. (2010) investigated the role of working memory in metaphor comprehension. Differently from Blasko (1999), in the study participants

were asked to decide whether the given expression was literally false or true. To assess working memory, Word Span Task was used. Adult participants' judgment on expressions was evaluated by the Metaphor Interference Effect task which included metaphors, scrambled metaphors, anomalous metaphors, and true statements in the form of X are Y. Participants were asked to judge whether the expression is literally false as fast as possible. The result demonstrated that individuals with a high working memory span were faster in judging that a given expression is literally false compared to individuals with a low working memory span. Since there are more properties of a word to be activated when it is used in a metaphorical expression relative to when it is used in a literal expression, individuals with high working memory span managed to involve in the inhibition of irrelevant properties faster relative to the participants with lower working memory span. Chiappe and Chiappe (2007) also revealed the relationship between the time required to interpret a metaphor and working memory capacity. The Listening Span task and Stroop task were used respectively to assess working memory and inhibition control. Participants were divided into two groups as a high and low working memory span group. Adult participants were asked to generate interpretations for the given metaphors in the form of X is Y. The results showed that individuals with both high working memory and inhibitory control capacity required less time to generate an interpretation of given metaphors compared to the participants with lower working memory capacity. The study also proposed that the quality of the interpretation was predicted by individuals working memory and inhibitory control capacity. The higher the capacity, the more qualified the interpretations were.

Further, Mashal (2013) investigated the role of working memory as modeled by Baddely and Hitch (1974) in the comprehension of familiar and unfamiliar metaphors. All participants had digit span forward and backward tasks to assess their short-term memory and central executive, respectively. In the first experiment, participants were asked to fill out a multiple-choice questionnaire. The questionnaire included familiar and unfamiliar metaphors as well as unrelated word pairs. There were four possible choices for each question: a correct metaphorical interpretation, a literal distracter that was related to the first noun in the expression, a literal distracter

related to the second noun in the expression, and a phrase suggesting the expression was meaningless. The result of the first experiment revealed that comprehension of both familiar and unfamiliar metaphors was correlated with the digit span backward task but not with the digit span forward task. They concluded that the central executive plays a role in understanding conventional metaphors regardless of their familiarities. In the second experiment, participants heard two-word expressions all of which were taken from the same stimuli pool as in the first experiment. After reading all presented expressions, participants were asked to fill out a questionnaire where the first word of each expression was presented alongside four alternative completion choices: the correct completion, a phonological distractor that rhymed with the correct completion, a semantic distractor that was semantically related to the correct completion and a plausible completion which could complete the expression but was not the same with original completion. The second experiment proposed a difference in the way familiar and unfamiliar metaphors are remembered. The result showed that when remembering familiar metaphors, participants chose semantic and phonological errors that were more common compared to plausible errors. Half of the errors made by the participants while recalling familiar metaphors were phonological errors. This finding suggested that familiar metaphors can be comprehended by rehearsing information in the phonological loop.

Besides the abovementioned studies, some papers investigated the effect of working memory deficit on metaphor comprehension (Papagno, 2001; Monetta & Pell, 2007). In their study, Monetta and Pell investigated the effect of a working memory deficit on metaphor comprehension in individuals diagnosed with Parkinson's disease. A healthy control group was also included in the study. All participants took the verbal working memory span task. The individuals in the experimental group were sub-divided into two groups according to their performance in the working memory span task. Then, a metaphor comprehension task including metaphorical and nonsense sentences was implemented. In the comprehension task, all of the participants were asked to judge the given expression whether they made sense or not. The result revealed a significant difference in the judging of metaphors among the individuals diagnosed with Parkinson's disease. Individuals with reduced working memory

capacity were impaired in metaphor comprehension while individuals with a similar disease stage, but without a deficit in working memory capacity performed largely like the individuals in the healthy control group.

The capacity in working memory as well as other cognitive functions varies among Individuals. In light of these studies, working memory capacity can account for individual differences in the performance of metaphor comprehension. Many of the studies in the literature revealed parallel results showing that working memory has a crucial role in retrieving and manipulating the information to find the proper meaning of the vehicle and the topic while creating a map between them. Thus, increasing the quality of the interpretation of metaphors. However, to our knowledge, none of these studies directly investigate the role of working memory capacity in metaphor comprehension in early childhood. Further studies are needed to reveal the effect of working memory span on the comprehension of metaphors across ages.

2.4. Present Study

The main aim of the present study is to investigate how novel and conventional metaphorical motion events (MMEs) in two different domains (emotion and body) are processed by Turkish preschool children, and the effect of inhibitory control and working memory on this process. Özçalışkan (2007) reported that children cannot define metaphors until age 5 when tested in a verbal task, which may be due to children's limited linguistic/production skills. To eliminate the language barrier, we conducted a child-friendly act-out study modeled after Hülagü and Özge, (2017). We use MMEs such as “sevinçten uçmak” (i.e., *to be floating on air from joy*), and “ümitsizliğe düşmek” (i.e., *to fall in despair*) because the nature of these utterances is easy and suitable for gesturing. Also, young children mostly rely on sensorimotor schemas to make sense of the world that surrounds them (Mandler, 1999; Piaget, 1973). Therefore, motion events which allow the use of bodily experience to understand action metaphors might enhance and accelerate the comprehension of MMEs leading to an earlier ability to process them compared to other types of metaphors. Also, many of the studies conducted in this field investigated the

comprehension of metaphors in the X is Y form (*e.g., The lawyer is a shark*). Few studies investigated how children understand MMEs (Özçalışkan, 2005; Özçalışkan, 2007).

In the non-verbal gesture-based act-out study, children were asked to gesture to the MMEs silently. Firstly, this method could be advantageous since it enables illustrating the initial step of metaphor comprehension. We hypothesized that if children depict gestures for the literal meaning of MMEs, it gives clues for the indirect-access model, revealing proof for decomposition. For the opposite situation, if children depict gestures for the correct metaphorical meaning, it may suggest a direct access to the metaphorical meaning without decomposition.

Secondly, considering the findings from previous studies focusing on the effect of inhibitory control and working memory on metaphor comprehension in adulthood, we predicted to observe similar effects of these factors on the processing of MMEs in preschool children.

Thirdly, we manipulated the conventionality of the MMEs to investigate the effect of familiarity and novelty on metaphor comprehension in early childhood. In line with the Career of Metaphor model (Gentner & Bowdle, 2001), we predicted that novel metaphors will be more difficult for children to metaphorically interpret relative to familiar and unfamiliar MMEs. We also hypothesized that familiar metaphors would receive greater metaphorical gestures and more accurate verbal explanations compared to the unfamiliar ones.

Finally, we also categorized MMEs in two different domains as emotion (e.g., *ümitsizliğe düşmek*) and body (e.g., *çenesi düşmek*). To date, these domains have never been tested. Having more concrete vehicles and being easier to illustrate literally, we predicted that MMEs with the body domain will be harder to interpret metaphorically.

2.5. Research Questions

(i) Do preschool children access meaning of metaphors directly or indirectly?

(ii) Does conventionality and novelty have an effect on the comprehension of MMEs comprehension in preschool children?

(iii) Do two domains of the metaphors, namely emotion and body domain, affect the processing of MMEs in preschool children?

(iiii) How does inhibitory control affect the understanding of MMEs in preschool children?

(iiiii) How does working memory affect the comprehension of MMEs in preschool children?

CHAPTER 3

METHOD

This chapter introduces the research methodology including participants, measures, and testing procedure under separate sub-sections. The study protocol was approved by the Middle East Technical University Human Research Ethics Committee numbered 28620816. A signed consent of the parents of each participant was taken prior to the study.

3.1. Participants

Twenty children (M_{Age}= 4:03, Range= 4:00 - 4:08, 11 female) participated in the experiment. The parents of each child reported that their children had a typical development. All participants were native speakers of Turkish and were reported to be monolingual. Children were recruited in a kindergarten in Hatay, Antakya. All of the children were reported to be enrolled in kindergarten for at least one year. Three children were excluded from the study because they did not want to take all the tasks and left the experiment before finishing it.

3.2. Measurements and Procedure

In this section, the materials used to assess metaphor comprehension and cognitive abilities and the procedure are introduced, separately.

3.2.1. Working Memory Measures

Working memory is a component of short-term memory. However, it differs from short-term memory by the fact that it requires the manipulation of the information

retrieved for a short period of time (Baddeley and Hitch, 1974). We measured working memory capacity by the backward digit span task from the Memory for Digit Span subtest from the Wechsler Intelligence Scales for Children-Revised (Wechsler, 1974). Phonological short-term memory was assessed by the digit span forward from the same scale (Wechsler,1974), and was used as a primary task for the backward digit-span task. We additionally assessed the phonological loop, which is a component of working memory and the ability to hold and manipulate auditory information over short intervals of time. We assessed this ability by using sentence repetition task (Aksu-Koç et al., 2002). The materials and procedure are explained in the next subsections.

3.2.1.1. Forward Digit Span Task

Phonological short- term memory was assessed by forward digit span task from the Memory for Digit Span subtest from the Wechsler Intelligence Scales for Children-Revised (Wechsler, 1974). This task is widely used with preschool children (Blom et al., 2014; Chen & Stevenson, 1988), and is used as a primary task for the backward digit span task (Yeter et al., 2022). The task included seven blocks in increasing order (i.e., *n representing the number of digits in each set: n, n, n+1, n+1, … n+6, n+6*). The first set included three digits while the last set included nine digits. This task required children to listen to the experimenter uttering the digits and repeat them in the same order as the experimenter did.

3.2.1.1.1. Procedure

All children were tested in a quiet room. The experimenter had the test printed on a paper and the children were told that they were going to play a number game. Children received a practical trial with one two-digits example at the beginning of the experiment and proceeded only if they gave the correct answers during the practical trials. Feedback and encouragement were provided only during the practical trial. The answers of the students were coded by the experimenter during the testing. All the answers were voice recorded by the experimenter for

further answer checking. The correct answers were coded as 1 while wrong answers were coded as 0. The task continued until the children received two successive 0 for a set consisting of the same number of digits. The maximum score in this test was 14.

3.2.1.2. Backward Digit Span Task

Working memory was assessed by backward digit span task from the Memory for Digit Span subtest from the Wechsler Intelligence Scales for Children-Revised (Wechsler, 1974). This task is widely used with preschool children (Blom et al., 2014; Bull et al., 2008; Lecce et al., 2018) to assess working memory. The task included seven blocks in increasing order (i.e., *n representing the number of digits in each set: n, n, n+1, n+1, … n+6, n+6*). The first set included two digits while the last set included eight digits. This task required children to listen to the experimenter uttering the digits and repeat them in the reverse order.

3.2.1.2.1. Procedure

All children were tested in a quiet room. The forward and backward digit span task were administered at once and respectively to all the participants. The children were again asked to listen to the experimenter uttering the digits. For this task, they were expected to repeat the digits in reverse order. All the children received practical trials with two digits examples to make sure they understood the task. Feedback and encouragement were provided only during the practical trials. The answers of the students were coded by the experimenter during the testing. All the answers were voice recorded by the experimenter for further answer checking. The correct answers were coded as 1 while wrong answers were coded as 0. The task continued until the children received two successive 0 for a set consisting of the same number of digits. The maximum score in this test was 14.

3.2.1.3. Sentence Repetition Task

Phonological loop was assessed by a Turkish sentence repetition task (Aksu-Koç et al., 2002). Sentence repetition task is widely used with preschool children (Riches,

2012; Rujas et al., 2021). The task included 20 Turkish sentences that progressively became longer and more complex in grammatical structure. The experimenter read the sentences by giving approximately one and half second pause between each word. The objective of the task is to repeat sentences verbatim immediately after the experimenter finishes a sentence.

3.2.1.3.1. Procedure

All children were tested in a quiet room. Prior to the experimental trials, participants were asked to mimic the experimenter. The experimenter performed four basic movements: putting the index finger on the nose, touching the head, tapping on the table twice and clapping the hands twice. After each of the movements, the experimenter asked the participants to mimic her and waited for the children to correctly do the same movement as the experimenter did. After correctly mimicking the experimenter, the children were presented with two sentences uttered by the experimenter, separately. After each of the sentences was uttered, the children were asked to repeat the same sentence. Feedback was given by the experimenter only for practical trials. After making sure that the child understood the requirements of the task, the experimenter presented the experimental items. The children were asked to repeat the verbatim sentences immediately after the experimenter. The answers of the participants were coded by the experimenter during the testing. All of their answers were voice recorded by the experimenter for further answer checking. The children who gave verbatim repetition received 1 point while the repetitions with at least one error were coded as 0. The task continued until the child received three successive 0s.

3.2.2. Inhibitory control Measures

3.2.2.1. Happy-sad Stroop Task

A Stroop-like happy-sad is used with preschool children (Ikeda et al., 2014) to assess inhibitory control. Happy-sad stroop task has been reported to have desirable

measurement properties since it did not show a ceiling effect in adults (Lagattuta et al., 2011). We used a happy-sad task adopted by Yeter, Ragbaliati and Özge (2021). The task was computerized using OpenSesame (Mathôt et al., 2012). The faces included in the task were taken from NimStim (Tottenham et al., 2009) from http://www.macbrain.org/faces/index.htm. Caucasian female model 9 and Caucasian male model 24 were used (A prior permission has been taken to use the pictures, however, publication of the model's photos is prohibited). The task included 20 faces, half of which represented a sad face while the other half depicted a happy face. The task consisted of either female or male faces. The assignment of the gender of the faces was counterbalanced.

3.2.2.1.1. Procedure

All children were tested in a quiet room. Children took the test on a computer. Half of the participants took the task with female faces while the other half took the male version of the task. The children received instruction before the task, and they were given eight practice trials including 4 sad and 4 happy faces. Encouragement and feedback were given only during the practical trials. After a brief break, experimental trials were presented. The total number of emotional faces that the participants saw was twenty (10 sad faces and 10 happy faces). The faces appeared in mixed order in a randomized way each time the test was run. The participants were asked to say the opposite of the emotion represented by the face on the screen (i.e., *say sad when they see a "happy" face and vice versa*). The accuracy (correct percentage) was calculated automatically for each child.

3.2.2.2. Child Flanker Task with Fish

Flanker task is used widely with preschool children to assess selective attention (Fatzer & Roebers, 2013; Oeri et al., 2019; Zelazo et al., 2013). We used a modified child-friendly version of Erikson Flanker Task (Erikson & Erikson, 1974) which was adapted by Christ and colleagues (2011). The task was downloaded from the Inquisit Test Library. The task differs from the adult version of flanker task, as the children

were shown a stimulus comprising a horizontal row of five red fish instead of arrows. The participants were required to pay attention to the center fish and press a specific response key on the keyboard (the key 'L' for right direction and the key 'A' for left direction) depending on the direction of the center fish. The keys were labeled with same-colored stickers to make it easy for preschoolers to distinguish the keys that they were required to press. The location of the specified keys was helpful for the children to assign the direction of the center target fish ('A' is on the left side of the keyboard while 'L' is on the right side of the keyboard). There were two trial types administered: congruent and incongruent. On congruent trials, the center fish looked the same direction with the flanking fish (e.g., < < < < < or > > > > >). On incongruent trials, the center fish pointed in the opposite direction than of those flanking fish (e.g., > > < > > or < < > < <).

3.2.2.2.1. Procedure

All children were tested in a quiet room. Children took the test on a computer. Two blocks of practice consisting of 20 trials each were administered. In the first practice block, the center target fish was demonstrated alone without any flanking fish to allow children to familiarize themselves with the task and practice paying attention to the direction of center target fish during the whole task. In the second practice block, the children were presented with five fish as in the experimental trial. Therefore, the second block prepared children for the experimental trials.

Each trial was presented until a response was made within 3000 ms. After 1500 ms of interval, a new trial was presented. 'Early response' message with a brief warning tone was shown on the screen if a child responded less than 200 ms. If a child failed to respond within 3000 ms, a brief warning tone following with the 'Too slow' message was presented on the screen. If a child gave the wrong answer by pressing any wrong key, 'wrong response' and a warning tone were presented on the screen. Since the participants were not literate, the experimenter read the messages loudly to the participants each time they occurred on the screen during the practical trials.

During the experimental trials, the participants were not informed with the messages on the screen. However, they heard the warning tone with the messages.

After the practical trials, 120 randomly intermixed trials were completed by each participant (60 congruent, 60 incongruent). The children were offered 1 minute break after 40 trials.

The score of percentage errors for both congruent and incongruent conditions were reported by the program at the end of each session. For each child, to calculate the incongruency effect, the percentage error of congruent trials was subtracted from the percentage error of incongruent trials (Rothbarth & Rueda, 2005; Van Steenbergen et al., 2010). More negative results indicated higher performance.

3.2.3. Metaphor Comprehension Measure

3.2.3.1. Materials for Non-verbal Gesture-based Act-out Task

It is reported that children cannot define metaphors until age five when tested in a verbal task (Özçalışkan, 2007), which may be due to children's limited linguistic production skills. To eliminate the language barrier, we conducted an act-out study modeled after Hülagü and Özge (2017). The task included 12 metaphors including four novel, four familiar and four unfamiliar MMEs, and seven literal expressions. The literal expressions included each of motion verbs used in the metaphorical items. For each group, half of the items were grouped as body domain and the other half as emotion domain (two novel MMEs in body domain and two novel MMEs in emotion domain). The domains were structured by motion in space as such, body is a container and emotion is a location, which describes the direction of motion in a space. We also manipulated the conventionality and novelty of the items. Although there are studies aiming to establish a database for Turkish words based on age of acquisition, frequency, imageability and familiarity (Ahsen-Acar et al., 2016; Göz et al., 2016; Selvi-Balo et al., 2020), there was a lack of database for the familiarity of metaphors and more specifically metaphorical motion events. To decide the

familiarity of the MMEs, we conducted a survey prior to this study. The survey consisted of 50 MMEs selected from the Turkish Language Association (TDK) dictionary. The survey was conducted via an online survey software, Qualtrics XM. 79 parents participated in the study. They were asked to rate each item from 1 to 7 in terms of their familiarity. The mean familiarity of each item was computed. The items with less than 4.0 mean value were grouped as unfamiliar while the items that received higher mean values than 5.0 were grouped as familiar (see Table 1). As for novel MMEs, the novel metaphors were judged by 10 native adult Turkish speakers. They judged these items whether they make sense or not. All of the participants agreed on the novel metaphors used in this study being meaningful. None of the novel items are available in the Turkish Language Association (TDK) dictionary.

Table 1. The classification of metaphor types used in the metaphor comprehension assessments.

	Body Metaphors	Emotion Metaphors
Metaphorical items	1.Çenesi düşmek (F=5.30) (to drop one's jaws) 2. Gözden kaçmak (F= 5.18) (to escape from the eye) 3. Dili dolaşmak (UF= 3.15) (tongue tangling) 4. Diline düşmek (UF=2.78) (to fall into one's tongue) 5. Midesi taşmak (N) (his/her stomach is overflowing) 6. Kalbinden düşmek(N)	1.Seviçten uçmak(F=5.63) (to fly on air from joy) 2.Keyfi kaçmak (F= 5.38) (His/her pleasure escaped) 3.Telaşa düşmek (UF= 4.00) (to fall into panic) 4. Ümitsizliğe düşmek (UF=3.94) (to fall into despair) 5. Mutluluğa varmak (N) (to arrive at happiness) 6. Üzüntüye dalmak (N)
Literal items	1. Çukura düşmek (to fall into a hole) 2. Köpekten kaçmak (to escape from a dog) 3. Müze dolaşmak (to walk around a museum) 4. Suyun taşması (Water overflow)	1. Kuşun uçması (bird flying) 2. Eve varmak (to arrive home) 3. Denize dalmak (to dive into the sea)

Table 1. (continued)

Note. This table shows the domain and familiarity of the items used in the metaphor comprehension assessments. Literal control items consist of the same motion verbs included in metaphorical expressions. English equivalents are given following each item. Familiarity types are shown with mean scores in the parentheses. The scores represent the mean values obtained from the survey out of 7. 7 was most familiar, and 0 was least familiar. F, familiar. UF, unfamiliar. N, novel.

3.2.3.1.1. Procedure

All the children were tested in a quiet room. Participants were introduced to a toy bear called Edi, by the experimenter. The experimenter told the participants that this bear could not hear but could see very well, and that they were going to play a game together with the bear. The children were required to demonstrate the meaning of the metaphorical motion verb phrases uttered by the experimenter, with their gesture, silently. Four practical trials were administered to ensure that participants understood the task. The participants were asked to demonstrate "yemek yemek" (i.e., *to eat*), "diş fırçalamak" (i.e., *to brush their teeth*) "saçlarını taramak" (i.e., *to comb their hair*) and "su içmek" (i.e., *to drink water*) with gestures without speaking to the bear. After correctly answering the practical trial, the children were randomly presented all 19 items aloud at a time and were expected to silently gesture the meaning of the phrase uttered. The experimenter did not give any feedback regarding whether their responses were correct or not. The answers of each participant were audio and video recorded by a camera during the testing.

3.2.3.1.2. Coding Procedure

The gestures demonstrated by the children were coded based on three categories; metaphorical-gesture response, wrong-or no-gesture responses and literal-gesture responses. While deciding for the literal-gesture response for a metaphorical item, we considered the counterpart literal control item as a reference. If the child gestured the same for the expressions included both metaphorical and literal use of the motion verb, we coded this gesture as literal. For example, one child started to run around

the room as if he was escaping from something when responding to “köpekten kaçmak” (i.e., *to escape from a dog*). The same child demonstrated exactly the same gesture for the expression “keyfi kaçmak” (i.e., *his/her pleasure escaped*). We coded these answers as literal-gesture responses. In another example, a child gestured by running around the room for “köpekten kaçmak” while he gestured as if he was sad, for the expression “keyfi kaçmak”. Therefore, she presented correct gestures for both the literal and metaphorical item. If the children said they did not know the meaning or if they presented an irrelevant or wrong gesture, we coded these gestures as null/wrong responses. For example, one child opened his mouth widely when the experimenter asked him to describe “üzüntüye dalmak” (i.e., *to dive into sadness*). We coded this gesture as a null/wrong response.

3.2.3.2. Materials for Verbal Explanation Task

The same items used in the non-verbal task were used in the verbal explanation task (see Table 1). We also conducted a verbal explanation task to present the metaphors in meaningful sentences to enhance children’s comprehension. Our goal was to allow children to elaborate more on metaphors by verbal encoding. By this, we aimed to gain a more comprehensive understanding of child metaphor processing. We asked children semi-fixed questions to allow them to elaborate more on the metaphors.

3.2.3.2.1. Procedure

After silently depicting the presented items in gesture, children were asked to verbally explain the meaning of the items. Children were presented with a sentence that contained the metaphorical expression (*e.g., you flew from joy*). Immediately after that, they were asked semi-fixed questions in the same order to each participant. Children were required to verbally explain what each of the items meant. They were also asked to explain how these expressions happened (*e.g., What does to fly from joy mean? How does flying from joy happen?*). The experimenter reminded the children that they could speak in this task. They were encouraged to elaborate on their answers. Their responses were audio and video recorded.

3.2.3.2.2. Coding Procedure

The same criteria of the non-verbal gesture-based act-out task coding were considered for the coding of the verbal explanations. The following explanations were coded as null/wrong responses. The real names of the participants are not given because of privacy reasons.

1. Ayşe, 52 months old, female.

R: Diyelim ki senin dilin dolaştı. Sence dili dolaşmak ne demek? Dili dolaşmak nasıl olur?	R: Let's say your tongue gets tangled. What does tongue tangling mean in your opinion? How does it happen?
C: Bilmiyorum.	C: I don't know.
R: Düşün bakalım. Sence ne olabilir.	R: Think about it. What can it be?
C: Ben bilmiyorum.	C: I don't know.

2. Melis, 53 months old, female.

R: Diyelim ki biri senin diline düştü. Sence diline düşmek ne demek? Nasıl olur?	R: Let's say someone falls on your tongue. What does falling into one's tongue mean? How does it happen? How does it happen?
C: Cumartesi günü olur.	C: It happens on a saturday.
R: Neden cumartesi günleri olur? Bana biraz anlatır mısın?	R: Why it happens on a saturday? Can you explain more?
C: Çünkü öyle.	C: Because so.

The following explanations were coded as literal explanations.

3. Zeynep,49 months old, female.

R: Diyelim ki sen ümitsizliğe düştün. Sence ümitsizliğe düşmek ne demek? Nasıl olur?	R: Let's say you fall into despair. What does falling into despair mean? How it happens?
C: Çukur kazarak düşerler	C: They dig a hole and fall into it.

4. Emre, 48 months old, male.

R: Diyelim ki sen sevinçten uçtun. Sence sevinçten uçmak ne demek? Nasıl olur?	R: Let's say you fly from joy. What does flying from joy mean? How does it happen?
C: Uçmak demek. Uçunca olur.	C: It means flying. It happens when we fly.

The following explanations were coded as metaphorical descriptions.

5. Doruk, 48 months old, male.

R: Diyelim ki sen üzüntüye daldın. Sence üzüntüye dalmak ne demek? Nasıl olur?	Let's say you fall into sadness. What does falling into sadness mean? How does it happen?
C: Mesela arkadaşım bana vurunca.	C: For example, when my friend hits me.

6. Nihal, 48 months old, female

R: Diyelim ki sen telaşa düştün. Sence telaşa düşmek ne demek? Nasıl olur?	R: Let's say you fall into a panic. What does falling into panic mean? How does it happen?
C: Ben küçükken tuvalette kaybolmuştum. Sonra telaşa düşmüştüm.	C: When I was a child, I was lost in a toilet. Then, I fell into panic.

CHAPTER 4

RESULTS

Two different tasks were used to assess children's understanding of familiar, unfamiliar and novel MMEs in emotion and body domains. One of the tasks was a nonverbal gesture-based act out task. The other one was a verbal explanation task conducted through an interview following the non-verbal gesture-based task. Inhibitory control and working memory capacities were also assessed. SPSS statistics program Version 28.0 for windows (IBM Corp., 2016) was used for the analyses.

4.1. Results for the Non-verbal Gesture-based Metaphor Comprehension Task

Our interest was whether inhibitory control and working memory had an effect on children's metaphor comprehension through gestures, and whether children's metaphor comprehension differed depending on conventionality and domain in the non-verbal gesture-based metaphor comprehension task. Since our dependent variable was categorical with three levels including scores for gesture responses (metaphorical responses, literal responses, null/wrong responses), we conducted a multinomial logistic regression test. We used a backward stepwise method to remove variables until we built the final model after fitting the full model with theoretically related factors and interactions. Bayesian Information Criteria (BIC) and Aikake Information Criteria (AIC) were used as references to assess model fitting. The initial model included these independent variables: the scores of happy-sad stroop task, child fish flanker task, forward digit span, backward digit span, sentence repetition, familiarity (familiar, unfamiliar and novel), domain (emotion, body), and our dependent variable: non-verbal gesture-based metaphor comprehension task scores (metaphorical responses, literal responses, null/wrong responses). Also, two-

way interaction between the scores of the happy-sad stroop task and conventionality, the scores of the happy-sad stroop task and domain, the scores of the child fish flanker task and conventionality, the scores of the child fish flanker task and domain were added to the initial model (ΔAIC =372, ΔBIC = 476). The steps for the backward stepwise method can be seen in Table 2. The final model included the independent variables: the scores of happy-sad stroop task, child fish flanker task, forward digit span, backward digit-span, sentence repetition task, familiarity (familiar, unfamiliar and novel), domain (emotion, body). and our dependent variable: non-verbal gesture-based metaphor comprehension task scores (null response, literal response, and metaphorical response). The final model yielded better AIC (356) and BIC (418) scores compared to the initial model including interactions. This model also yielded significant improvements in the model fit based on the AIC and BIC scores compared to intercept model (ΔAIC =448, ΔBIC =455). Compared to the initial model that included only the intercept, addition of the predictor variables to the model significantly improved the data fit to the model X^2(16, N=240) = 123.86, Nagelkerke R^2= .46, p <.001. The goodness-of-fit tests for the multinomial logistic regression model revealed non-significant results for the Pearson chi-square test (χ^2 = 256, df = 222, p > .05), suggesting that the model provided a fit to the data. As shown in Table 4, significant unique contributions were made only by the score of happy-sad stroop task, familiarity, and domain. The results demonstrated that children were more likely to gesture literal (%47), or null responses (%32) compared to metaphorical responses (%21) in the nonverbal gesture-based act-out task (see Table 3).

Table 2. The steps of the backward stepwise method for the non-verbal gesture-based act out task

Model	Action		AIC	BIC
Model 1	Entered	All effects included	372	476
Model 2	Removed	Happy-sad stroop task * domain	368	466
Model 3	Removed	Child flanker task with fish * conventionality	363	446

Table 2. (continued)

Model 4	Removed	Child flanker task with fish * domain	360	437
Final	Removed	Happy-sad stroop task * conventionality	356	418

Note. * refers to the interaction between the variables.

Table 3. *The number of responses occurred in the non-verbal gesture-based act-out task N=240*

Null Responses Count	Literal Responses Count	Metaphorical gesture Count
77	112	51

Table 4. *Predictors' Unique Contributions in the Multinomial Logistic Regression (N=240)*

Predictor	X^2	df	p
Happy- Sad task	7.748	2	**.021***
Fish flanker	3.821	2	.148
Digit-span backward	2.414	2	.299
Digit-span forward	.407	2	.816
Sentence repetition	.090	2	.956
Familiarity	37.024	4	**<.001****
Domain	79.691	2	**<.001****

Note. X^2 = amount by which -2 log likelihood increases when the predictor is removed from the full model.

** p< .01

* p< .05

The result of multinomial logistic regression is presented in Table 5.

Table 5. Parameter Estimates Contrasting the metaphorical versus literal and null responses (N= 240)

Predictor	Metaphorical vs.	B	OR	p
Happy- Sad task	Literal response	-.033	.967	**.011***
	Null/wrong response	-.031	.970	**.013***
Fish flanker	Literal response	-.011	.990	.268
	Null/wrong response	.004	1.004	.710
Digit-span backward	Literal response	.124	1.132	.650
	Null/wrong response	-.180	.835	.475
Digit-span forward	Literal response	-.111	.895	.709
	Null/wrong response	.029	1.029	.919
Sentence repetition	Literal response	-.013	.987	.825
	Null/wrong response	-.001	.999	.988
Familiarity				
Familiar vs novel	Literal response	2.085	8.049	**<.001****
	Null/wrong response	1.005	2.732	.044
Familiar vs unfamiliar	Literal response	-1.084	2.958	.07
	Null/wrong response	-1.453	4.277	**.014***
Domain				
Body vs emotion	Literal response	4.075	0.017	**<.001****
	Null/wrong response	2.465	11.761	**<.001****

Note. OR= odds ratio associated with the effect of a one standard deviation increase in the predictor.

*p< .05

**p< .01

Only the happy-sad stroop task score out of all cognitive tasks was a significant predictor (see Figure 1) for comparing the metaphorical gesture responses with the literal ones (p=.011). Better scores in the happy-sad stroop task increased the possibility of metaphorical gesture responses. Also, novel metaphors were more likely to be gestured metaphorically compared to familiar metaphors. However, familiar, and unfamiliar metaphors did not differ significantly in terms of metaphorical responses given by the children compared to literal responses. Yet, there was a trend showing that familiar metaphors received overall more metaphorical responses compared to unfamiliar metaphors. Moreover, unfamiliar metaphors were more likely to receive null responses compared to familiar ones (p=.014). As for domain, metaphors with emotion domains were more likely to be gestured metaphorically relative to metaphors with body domains. A chi-square test of independence was performed to examine the relation between familiarity and domain in the non-verbal gesture-based act-out task (see Table 6).

Figure 1. Simple line mean of happy-sad Stroop task by non-verbal gesture-based task

Figure 1 shows the simple line mean of happy-sad Stroop task by non-verbal gesture-based task. The higher mean happy-sad Stroop task corresponded to more metaphorical gesture responses.

Table 6. Pearson Chi Square Test results for familiarity and domain for non-verbal gesture-based task

		Non-verbal Gesture-based Task							
		Null Response		Literal Response		Metaphor Response		X^2	p
		N	%	N	%	N	%		
Familiar	Emotion	11	27.5	16	40	13	32.5	11.3	0.003**
	Body	10	25	28	70	2	5		
Unfamiliar	Emotion	24	60	10	25	6	15	27.6	<0.001**
	Body	7	17.5	33	82.5	0	0		
Novel	Emotion	10	25	3	7.5	27	67.5	34.6	<0.001**
	Body	15	37.5	22	55	3	7.5		

Note. X^2*=Chi square statistic value*

** p< .01

* p< .05

As shown in Table 6, for all of the familiarity levels, there was a significant difference between the processing of metaphors with emotion and body domain. The number of metaphorical responses given to emotion metaphors was significantly higher compared to the number of metaphorical gesture responses given to metaphors with body domain, across all familiarity levels. None of the children gestured metaphorically for unfamiliar metaphors with body domain. Also, novel metaphors with the emotion domain received significantly higher number of metaphorical gesture responses compared to ones with the body domain. These findings are discussed in Chapter 5.

4.2. Results for the Verbal Explanation Task

Our second interest was whether inhibitory control and working memory have an effect on children's metaphor comprehension abilities through a verbal explanation

task, and whether children's metaphor comprehension will differ depending on conventionality and domain in the verbal explanation task. Since our dependent variable was categorical with three levels including scores for verbal responses (metaphorical responses, literal responses, null/wrong responses), we conducted a multinomial logistic regression test. We used the backward stepwise method to remove variables until we built the final model after fitting the full model with theoretically related factors and interactions. Bayesian Information Criteria (BIC) and Aikake Information Criteria (AIC) were used as references to assess model fitting. The initial model included the independent variables (predictors): the scores of happy-sad stroop task, child fish flanker task, forward digit span, backward digit span, sentence repetition, familiarity (familiar, unfamiliar and novel), domain (emotion, body), and dependent variable: verbal explanation task scores (metaphorical responses, literal responses, null/wrong responses). Also, two-way interaction for the scores of backward digit span and conventionality, the scores of backward digit span and domain, the scores of the sentence repetition and conventionality, the scores of the sentence repetition and domain were added to the initial model. The steps for the backward stepwise method can be seen in Table 7. The final model yielded better AIC (335) and BIC (397) scores compared to the initial model including interactions (ΔAIC= 346, ΔBIC= 451) and intercept model (ΔAIC= 455, ΔBIC= 450). Compared to the model that included only the intercept, addition of the predictor variables to the model significantly improved the data fit to the model $X^{2(}16$, N=240) = 140.51, Nagelkerke R^2= .50, p <.001. The goodness-of-fit tests for the multinomial logistic regression model revealed non-significant results for both the Pearson chi-square test (χ^2 = 243.95, df = 222, p > .05) and the deviance test (χ^2 = 231.19, df = 222, p > .05), suggesting that the model provided a satisfactory fit to the data. As shown in Table 9, significant contributions were made by all of the predictors except the scores of the happy-sad Stroop task. The results revealed that the number of null responses was higher (%47) than literal verbal explanation (%28) and metaphorical verbal explanations (%25) in the verbal explanation task (see Table 8).

Table 7. The steps of the backward stepwise method for the verbal explanation task

Model	Action		AIC	BIC
Model 1	Entered	All effects included	346	451
Model 2	Removed	Sentence repetition task * conventionality	341	431
Model 3	Removed	Sentence repetition task * domain	338	422
Model 4	Removed	Backward digit span * domain	336	413
Final	Removed	Backward digit span * conventionality	335	397

Note. * refers to the interaction between the variables.

Table 8. The number of responses occurred in the verbal explanation task (N=240)

Null Responses Count	**Literal Responses Count**	**Metaphorical gesture Count**
113	67	60

Table 9. Predictors' Unique Contributions in the Multinomial Logistic Regression(N=240)

Predictor	X^2	df	p
Happy- Sad task	3.816	2	148
Fish flanker	11.018	2	**.004***
Digit-span backward	7.764	2	**.021***
Digit-span forward	9.796	2	**.007***
Sentence repetition	34.651	2	**<.001****
Familiarity	37.335	4	**<.001****
Domain	64.107	2	**<.001****

Note. X^2 = amount by which -2 log likelihood increases when the predictor is removed from the full model.

** p< .01

* p< .05

The results of multinomial logistic regression are presented in Table 10.

Table 10. Parameter Estimates Contrasting the metaphorical versus literal and null responses (N= 240)

Predictor	Metaphorical vs.	B	OR	p
Happy- Sad task	Literal response	.002	1.002	.888
	Null/wrong response	.017	1.018	.142
Fish flanker	Literal response	-.010	.990	.108
	Null/wrong response	.014	1.015	.710
Digit-span backward	Literal response	-.636	.529	**.020***
	Null/wrong response	-.637	.529	**.009***
Digit-span forward	Literal response	.131	1.140	.698
	Null/wrong response	.695	2.003	**.014***
Sentence repetition	Literal response	.010	1.010	.903
	Null/wrong response	-.233	.793	**<.001****
Familiarity				
Familiar vs novel	Literal response	2.307	10.045	**<.001****
	Null/wrong response	1.302	3.676	**.008***
Familiar vs unfamiliar	Literal response	-1.034	2.812	.06
	Null/wrong response	-.966	2.629	.07

Table 10. continued

Domain				
Body vs emotion	Literal response	3.655	38.67	**<.001****
	Null/wrong response	2.753	15.692	**<.001****

Note. OR= odds ratio associated with the effect of a one standard deviation increase in the predictor.

** p< .01

* p< .05

Only backward digit span score had a significant effect on giving metaphorical verbal responses (see Figure 2) when compared with the literal verbal responses (p=.02). Better scores in backward digit span task increased the possibility of metaphorical verbal responses. Both backward digit span backward (p=.009) and sentence repetition task (p<.001) had a significant effect in predicting null responses compared to metaphorical verbal responses. Lower scores indicated a greater probability of null responses in the verbal explanation task. The forward digit span task also had a significant effect in predicting the null responses; a better score in this task indicated a higher chance for a null response (p=.014).

A significant effect was also observed for domain and familiarity when comparing metaphorical verbal responses with both literal and null verbal responses. Metaphors with emotion domain were more likely to be explained metaphorically compared to those with body domain (p<.001). Similar to the non-verbal gesture-based act out task, novel metaphors were more likely to be explained metaphorically by children compared to familiar metaphors (p<.001). No significant difference was observed for the metaphorical verbal explanations given for the familiar and unfamiliar metaphors. A chi-square test of independence was performed to examine the relationship between conventionality and domain in the verbal explanation task (see Table 11).

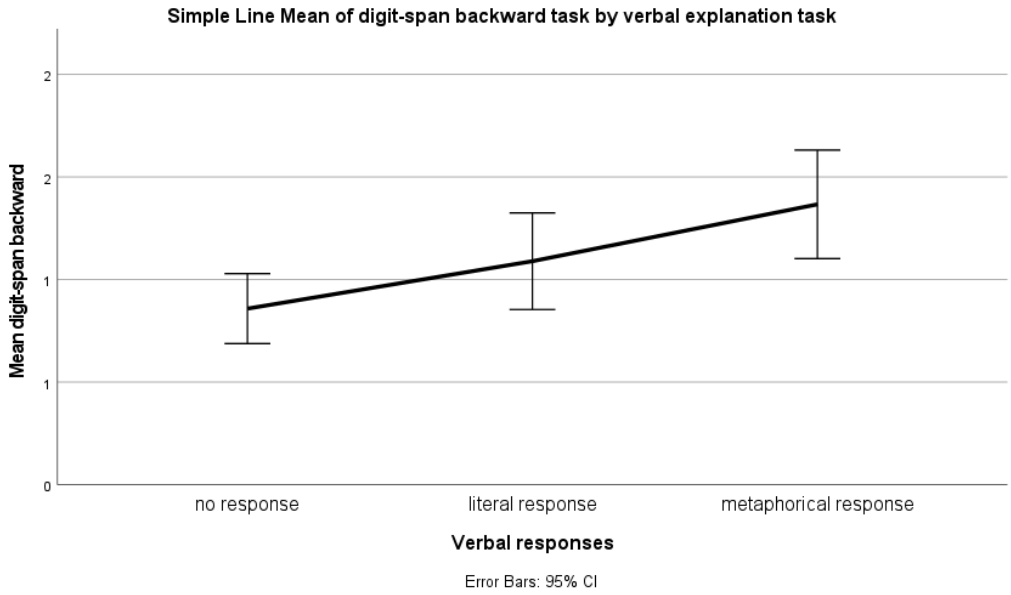

Figure 2. Simple line mean of digit-span backward task by verbal explanation task

Figure 2 shows that simple line mean of digit-span backward task by verbal explanation task. The higher mean digit-span backward task corresponded to more metaphorical gesture responses.

Table 11. Pearson Chi-Square Test results for familiarity and domain for verbal explanation task

		Verbal Explanation Task							
		Null Response		Literal Response		Metaphorical Response		*x2*	p
		N	%	N	%	N	%		
Familiar	Emotion	19	47.5	7	17.5	14	35	12.68	0.002**
	Body	18	45	19	47.5	3	7.5		
Unfamiliar	Emotion	22	55	9	22.5	9	22.5	14.02	<0.001**
	Body	19	47.5	21	52.5	0	0		
Novel	Emotion	9	22.5	2	5	29	72.5	29.65	<0.001**
	Body	26	65	9	22.5	5	12.5		

Note. X^2*=Chi square statistic value*

** p< .01

* p< .05

As shown in Table 8, for all of the familiarity levels there was a significant difference between the processing of metaphors with emotion and body domain. The number of metaphorical verbal explanations given to emotion metaphors was significantly higher compared to the number of metaphorical verbal responses given to body metaphors. None of the children gave verbal explanations metaphorically for unfamiliar body metaphors while unfamiliar emotion metaphors received %22.5 of metaphorical verbal responses. Also, novel emotion metaphors received significantly higher number of metaphorical verbal responses compared to novel body metaphors. These findings are discussed in Chapter 5.

CHAPTER 5

DISCUSSION

This study investigated whether Turkish preschool children as young as age four process MMEs, directly or indirectly and whether there is an effect of conventionality, domain, inhibitory control, and working memory capacity on the processing of MMEs. In that regard, children were assessed through non-verbal and verbal metaphor comprehension tasks as well as cognitive tasks measuring inhibitory control and working memory. The findings highlighted domain specific differences in the processing of metaphors. Also, inhibitory control and working memory were significant predictors for children's metaphor comprehension.

5.1. Do children process MMEs with direct or indirect access? Does the domain affect the processing of MMEs?

We used two different metaphor comprehension tasks, namely, the non-verbal gesture-based metaphor comprehension task and the verbal explanation task to investigate how children process metaphors.

In non-verbal gesture-based act out task, children gestured more literally compared to metaphorical responses. Our results revealed that domain had an impact on how metaphors were processed by children. Children used more metaphorical gestures for emotion metaphors compared to body metaphors. Similarly, in verbal explanation task, children uttered more metaphorical verbal explanations for metaphors with emotion domain relative to metaphors with body domain. This suggests that emotion metaphors are accessed directly without decomposition and described through gestures and explanations referring to their metaphorical meaning. On the other hand, body metaphors are processed indirectly; that is, children initially access the

literal meaning of the body metaphors and describe those metaphors through literal physical events. For example, none of the children gestured or verbally explained "çenesi düşmek" (i.e., *his/her jaw drops*) metaphorically. Rather, most of the children gestured and gave explanations as if their jaw was cut and was falling towards the ground. This suggests that when the vehicle of the metaphor is a concrete object (i.e., *body in this case*), the literal meaning of the expressions is activated initially. Yet, emotion metaphors displayed a different pattern. Children demonstrated more metaphorical gestures and uttered more metaphorical verbal explanations for emotion metaphors. For example, for the expression "üzüntüye dalmak" (i.e., *to fall into sadness*), children mostly mimicked a sad face, directly depicting the metaphorical meaning of the utterance. These findings support the conceptual metaphor theory of Lakoff and Johnson (1980). They suggested that a wide range of abstract concepts (e.g., *emotion, idea, time*) are mostly structured and understood through space and motion. According to the conceptual metaphor theory, the abstract concepts are conceptualized as concreate, physical concepts (e.g., *fell in love*), and individuals perceive abstract concepts figuratively through concreate experiences (e.g., *love is a container and people fall in it when they experience the love*). This theory further proposes that concreate physical concepts are not structured and perceived through abstract concepts, but they can be initially understood literally. In that regard, our results are in line with the existing literature proposing that the domain of the metaphor influences the way it is processed (Erdoğdu, 2023). Previous adult studies providing inconsistent support for direct (Glucksberg & Keysar, 1990; Gibbs, 1994a) and indirect access (Grice, 1975; Searle, 1979) models did not manipulate the domain of the metaphors. We conjecture that this may be one of the reasons for these conflicting findings in the literature. Further studies are needed to investigate metaphors with variety of domains to have a better insight on domain-based differences in metaphor processing.

5.2. Does conventionality and novelty affect the processing of MMEs?

We investigated whether children's metaphor comprehension differs depending on conventionality and novelty of MMEs. There were an equal number of familiar, unfamiliar, and novel MMEs.

Firstly, children gave more metaphorical responses both in the verbal and the non-verbal task for familiar metaphors compared to unfamiliar ones. Although the difference was not statistically significant, there was a trend showing that unfamiliar metaphors received overall less metaphorical verbal and non-verbal responses relative to familiar ones. It might suggest that as Giora (1997) claimed unfamiliar metaphors are not directly accessed; rather they initially trigger the literal meaning while the meaning of familiar metaphors is stored as separate lexical items in long term memory. Moreover, in the non-verbal gesture-based act out task, unfamiliar metaphors were significantly given more null/wrong responses relative to familiar metaphors which aligns with the findings of Hülagü and Özge (2017). These findings are also in line with the previous studies emphasizing that conventionality affects metaphor processing strategies (Bowdle & Genter, 2005; Jones & Estes, 2006; Dulcinati et al., 2014).

Secondly, the results revealed that children performed significantly better in the interpretation of novel metaphors compared to familiar ones, which is opposite of our expectations. Most of the children interpreted novel emotion metaphors metaphorically while they interpreted novel body metaphors more literally. Also, when novel emotion metaphors are compared with unfamiliar and familiar metaphors with the same domain, children performed better in comprehending novel emotion metaphors. Previous studies proposed that novel metaphors are cognitively more demanding since they require a new mapping between the topic and the vehicle (Bowdle & Gentner, 2005). The conflicting result we have might be explained by the emotional terms we used in novel emotional metaphors. “Mutluluk” (i.e., *happiness*) and “üzüntü” (*i.e., sadness*) were used as abstract topics in our novel emotion metaphors. However, “keyif” (*i.e., pleasure*), “ümitsizlik” (*i.e., despair*), “telaş” (*i.e., rush*), and “sevinç” (*i.e., joy*) were used as the abstract topics for familiar and unfamiliar emotion metaphors. Although most of the children were familiar with the word sevinç (*i.e., joy*) many of them were less familiar with the words “keyif” (*i.e., pleasure*), “ümitsizlik” (*i.e., despair*), and “telaş” (*i.e., rush*). As discussed, according to the conceptual metaphor theory people structure and perceive emotions figuratively. To arrive at the intended metaphorical meaning, listeners focus on the

abstract concepts (e.g., *emotions in this case*). Thus, it might suggest that children had difficulty in arriving at the metaphorical meaning for the emotional terms that they are not familiar with. Thus, contrary to our prediction, children demonstrated more metaphorical understanding for novel metaphors, which is most probably due to familiar abstract topics we used in novel metaphors.

5.3. Does inhibitory control affect the processing of MMEs?

This study revealed inhibitory control plays a significant role in metaphor comprehension and is a good predictor for children's understanding of metaphors, which is a novel piece of finding. Giora's (1997) dual access model suggests that the literal meaning of the words should be inhibited to arrive at the figurative meaning of the expression. As predicted, the children with better happy-sad stroop task score were more likely to gesture metaphorically. For example, we asked participants to gesture silently for the expression "sevinçten uçmak" (*i.e., be flying on air from joy*). One participant with a %20 accuracy rate in the happy-sad stroop task mimicked a bird flying in the air, by using her arms as wings, suggesting that she processed the motion verb "uçmak" (*i.e., to fly*) literally. Another participant who scored %100 in the happy-sad Stroop task, on the other hand, smiled really big while jumping around with joy. It is worth noting that the non-verbal gesture-based task used in this study did not require any language production skills but did require an understanding of the expressions. If the initial meaning triggered by the expression were the literal one, the gesture produced by individuals with low score in the stroop task would be the literal gesture, and the gestures produced by the individuals with high scores would be metaphorical. This was exactly what we found. Thus, our results support the Giora's (1997) dual access model suggesting that to understand a metaphorical utterance, individuals should initially suppress the literal meaning of the words used in the expression so as to come up with possible figurative meaning. Hence, better inhibitory control leads to a greater ability to suppress the literal meaning of the vehicle. In that sense, our results align with the previous studies conducted with adult participants, revealing that better inhibitory control is linked to better performance in metaphor comprehension (Carriedo et al., 2016; Chiappe & Chiappe,

2007). To the best of our knowledge, it is the first study showing the effect of inhibitory control on metaphor processing in preschool children.

With respect to conventionality, we did not observe a difference between the effect of inhibitory control on the processing of novel and conventional metaphors. Bowdle and Gentner (2005) suggested that novel metaphors are more cognitively demanding compared to conventional metaphors since the listeners should create a new map between the vehicle and the topic. Therefore, the involvement of inhibitory control in the process should be higher than its involvement in the processing of conventional metaphors, which was not observed in our findings. This might stem from two things. Firstly, familiar abstract topics included in our novel metaphors led children to arrive at the metaphorical meaning directly, which required less inhibitory control. Secondly, limited sample size may be insufficient to detect the interactions between inhibitory control and conventionality.

Similarly, with respect to domain, we predicted that body metaphors, compared to emotion metaphors, would require more cognitive demand for the inhibition of the literal meaning as their vehicles are concrete. However, we did not observe such a difference. This may be due to limited sample size.

Contrary to happy-sad stroop task, the child fish flanker task was not significantly related to the metaphorical gesture responses. It might be due to the fact that this task was demanding for children in terms of motor skills. Although this task has been reported to be used with preschool children (Fatzer & Roebers, 2013; Oeri et al., 2019; Zelazo et al., 2013), our participants had difficulty while performing this task due to their motor skills. They were too slow at pressing the related keys on the keyboard even though they made the correct judgement. It might explain the insignificant effect of this task on participants' gesture responses since it could not measure their inhibitory control ability due to lack of completely developed motor skills.

Additionally, we did not observe a significant effect of inhibitory control in the verbal explanation task. The non-verbal gesture-based act out task required metaphor

comprehension while verbal explanation task required both language comprehension and production. Since all children took the verbal explanation task immediately after the non-verbal gesture-based act out task, they had time to inhibit and revise the literal meaning of the expression activated by the time they were asked to explain these expressions verbally. Therefore, inhibitory control helped participants to arrive at the metaphorical meaning only in the non-verbal task. The following verbal explanation task required them to rely more on their language production skills which was reported to be closely related with working memory capacity (Dennis & Cabeza, 2008; Kemper & Sumner, 2001). Thus, it may suggest that inhibitory control is significant in the initial stage of metaphor processing when listeners should suppress the literal meaning of the vehicle. After that, listeners should retrieve and maintain information regarding the possible meaning of the words and should manipulate this information to build a figurative meaning which requires working memory.

5.4. Does working memory affect the processing of MMEs?

The results of the study revealed that working memory plays a significant role in metaphor processing and is a good predictor for children's verbal responses for metaphors, which is parallel with our hypothesis. The children with better backward digit span scores gave more metaphorical verbal explanations for the metaphors. For example, we asked participants to verbally explain the expression "gözden kaçmak" (*i.e., to escape from eye*). One child who scored 0 out of 14 gave the following explanation for this item; "I run, and a scary eye runs after me", suggesting that she takes the meaning literally. It also supports the findings revealed by Rosenstiel and Gardner (1976). In their study, they revealed that children at the age of five uttered more magical explanations for the metaphorical expressions, as if they happened in a magical world. However, we did not specifically classified children's verbal responses as including magical features or not. Therefore, we cannot conclude that children at the age of four, just as five-year-olds, have the tendency to understand metaphors literally as if they happen in a magical world. Further studies may classify verbal responses according to their features to refer to this issue. Children with better

backward digit span scores, on the other hand, gave more metaphorical verbal responses. A child who scored 3 in the digit-span backward task, which was the highest score among all participants, gave the following explanation for the same item; “there is something in this side (pointing to somewhere in the room) but I look this side (pointing opposite direction in the room) so I cannot notice the thing”. He, therefore, explained the expression metaphorically. Our results showed that the backward digit span that requires rehearsing and manipulating information, is a significant predictor for the correct interpretations of metaphors. This finding supports Kintsch’s (2000) computational model of metaphor comprehension. Kintsch (2000) proposed that the representation of words' meaning is computed to select the contextually proper interpretation of metaphors by inhibiting other meanings that do not apply to the topic. This process, therefore, would require working memory capacity to retrieve, maintain and manipulate the representation of word’s meaning as well as inhibitory control to inhibit the irrelevant meanings. Moreover, forward digit span was not a significant predictor for metaphorical responses. These findings align with the previous results reported in the literature (Chiappe & Chiappe, 2007; Mashal, 2013). Since forward digit span primarily requires temporary storage in the short-term memory, it may not have reflected the process that took place during the metaphor processing where listeners should also manipulate the information in memory. We also assessed phonological loop since Mashal (2013) revealed that participants made more phonological errors while remembering familiar metaphors compared to unfamiliar ones. Therefore, it was proposed that phonological loop could be responsible especially for the processing of familiar metaphors. However, our results did not support this claim. Sentence repetition task did not show a significant effect on metaphor processing in any of familiarity type. Mashal (2013) used a task where participants needed to remember the familiar and unfamiliar metaphors. However, we asked participants to interpret the metaphors. This conflicting result might be due to the objectives of the task we used in this study. While remembering metaphors, as Mashal (2013) stated, participants might use a recall strategy that involves the phonological loop. However, while interpreting the metaphors, listeners should mainly activate semantic features of the topic and the vehicle for long enough to form the best map between these two components while

inhibiting the irrelevant meanings, which would not rely only on phonological loop. However, it should be noted that our sample size was not enough to detect interactions between the variables. Therefore, further studies are needed with a bigger sample size to conclude the effect of phonological loop on the processing of familiar metaphors.

Also, the effect of working memory capacity was observed in the verbal explanation task but not in the non-verbal gesture-based act-out task. Previous studies that focused on the relationship between working memory and metaphor comprehension in adults used tasks that required language production such as metaphor generation or interpretation (Blasko, 1999; Carriedo et al., 2016; Chiappe & Chiappe, 2007). Similarly, in our study, we found that working memory was significantly related to the performance in the metaphor comprehension task which required language production. Considering that working memory capacity is also closely related to the language production ability (Dennis & Cabeza, 2008; Kemper & Sumner, 2001), it is also expectable for individuals with higher working memory capacity to utter deeper and more detailed verbal explanations for metaphors. We did not assess children's verbal responses in terms of how much they were detailed and deep as in Blasko's (1999) study but rather whether their answers were metaphorical or not. Further studies are needed to investigate the relationship between working memory and the quality of verbal metaphorical responses in children.

CHAPTER 6

CONCLUSION

The current study examined how Turkish preschool children at age four process metaphors and the effect of inhibitory control, working memory, conventionality, and domain in this process. The findings revealed that children adopted different strategies based on the domain while processing metaphors. When the domain was concrete, children created a map between the literal meaning of the vehicle and the topic. This suggested that children indirectly accessed the meaning of concrete metaphors. When the domain was abstract, on the other hand, they created a map between the abstract meaning of the topic and the metaphorical meaning of the vehicle, suggesting a direct access to the meaning. These findings revealed that there might not be a unified way of processing metaphors and domain affects the way children process metaphorical expressions (Erdoğdu, 2023). Furthermore, both inhibitory control and working memory were found to be significant in metaphor processing in children. Findings suggested that both inhibitory control and working memory hold a significance in metaphor processing in preschool children, similar to metaphor processing in adulthood. Inhibitory control plays a crucial role in the initial steps of metaphor processing where it is required to suppress the literal meaning of the vehicle to arrive at the metaphorical meaning. Better inhibitory control leads to a better understanding of metaphors. Similarly, working memory capacity is responsible for the following steps of metaphor interpretation which requires both language comprehension and production. It allows listeners to retrieve information from the memory regarding the semantic features of the topic and the vehicle to find the best features to create a map between them. To the best of our knowledge, it is the first study revealing the effect of inhibitory control and working memory on metaphor processing in preschool children.

6.1. Limitations and Further Studies

Langugae ability of children has been reported to be positively correlated with metaphor processing (Rundblad & Annaz, 2010; Huang et al., 2015). Although, we used Turkish Expressive and Receptive Language Test (TIFALDI) to measure participants' expressive and receptive language skills, our data collection in Hatay was interrupted due to the earthquake hit Turkey on 6th of February, 2023. Therefore, we could not include participants' language task scores in the study. Further studies should also consider the effect of language skills on the processing of metaphors. Also, there was a lack of standardized non-verbal metaphor comprehension tasks. Therefore, we adopted a gesture-based metaphor comprehension task (Hülagü & Özge, 2017) with same methodology but different items. Further studies are needed to create a standardized non-verbal metaphor comprehension task for preschool children. Moreover, we presented metaphorical items in meaningful sentences but not in a rich context, further studies should provide metaphorical items in a richer context to enhance the semantical cues for children's understanding of the expressions. Also, a larger sample size would help to enrich the robustness of the findings. Finally, our goal was also to examine the effect of an inhibitory control training program on metaphor comprehension ability in preschool children. Our inhibitory control training program was for one month. However, it was interrupted by the earthquake. Considering the effect of inhibitory control in the metaphor processing, an improvement in this skill might enhance metaphorical comprehension as well. Further studies should focus on interventions to train inhibitory control and working memory capacity to explore the transferred effect of training on the metaphor comprehension abilities.

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APPENDICES

A. APPROVAL OF THE METU HUMAN SUBJECTS ETHICS COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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Sayı: 28620816 / 01

14 OCAK 2021

Konu : Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi : İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Duygu ÖZGE

"Metafor Çözümleme Süreçlerinin Gelişimi ve Diğer Bilişsel Süreçlerle İlişkisi" başlıklı araştırmanız İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **001-ODTU-2021** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

[redacted]

Prof. Dr. Mine MISIRLISOY
İAEK Başkanı

B. PARANTEL INFORMED CONSENT FORM

Gönüllü Katılım Formu

Çocuğunuzu ve sizi, Orta Doğu Teknik Üniversitesi ODTÜ Yabancı Diller Eğitimi Bölümü araştırmacılarından Doç. Dr. Duygu Özge gerçekleştirilen ve çocuklarda sembolik dil anlama yetisinin gelişimini araştıran bu çalışmaya katılmanız için davet etmekteyiz. Bu çalışma, Orta Doğu Teknik Üniversitesi Yabancı Diller Eğitimi Bölümü kapsamında, Doç. Dr. Duygu Özge danışmanlığında yürütülen "Metafor Çözümleme Süreçlerinin Gelişimi ve Diğer Bilişsel Süreçlerle İlişkisi" başlıklı ve "220K034" numaralı TÜBİTAK projesinin bir parçasıdır. Bu çalışma, ileride yapılacak psikolojik ve dilbilimsel çalışmalar için temel oluşturacağından, katılımınız ileriye dönük araştırmalar için de faydalı olacaktır.

Bu araştırmanın temel amacı, 4-4.5 yaş grubundaki çocuklarda ket vurma ve dikkat yetilerinin geliştirilmesidir. Ket vurma yetisi dürtülenen davranışın baskılanması olarak tanımlanabilir. Örneğin, şekeri çok seven bir çocuğun canı istese dahi zararlı olduğunu bildiği için fazla şeker yemekten kaçınması yüksek bir ket vurma yetisi gerektirir. Ket vurma yetisi yüksek olan bireylerin ileriki yaşlarda akademik, iş ve sosyal hayatlarında daha başarılı olduğunu gösteren çalışmalar bulunmaktadır. Aynı zamanda bu yetisi yüksek çocukların dil becerileri de daha hızlı gelişim gösterdiği düşünülmektedir. Araştırma, çocuğunuzun değerlendirilmesi olarak algılanmayacak, veriler teşhise yönelik kullanılmayacaktır. Çalışma kapsamında çocuğunuz aşağıda belirtilen etkinlikleri yapacaktır.

Araştırmacılarımız tarafından çocuğunuzun dil ve bilişsel gelişimini desteklemek amacıyla 4 hafta boyunca çocuğunuza interaktif eğitimler verilecektir. Eğitimler sınıf ortamında oynanan grup oyunlarını içermekte olup asla ders şeklinde işlenmeyecektir. Çocukların eğlenmesi eğitimin amaçlarından biridir. Eğitim öncesi ve sonrası yapılacak olan değerlendirmelerde çocuklarınızın verdiği yanıtlar sonrasında değerlendirilmek amacıyla kayıt altına alınacaktır. Bu kayıtlar değerlendirme dışında başka hiçbir amaçla kullanılmayacak olup sadece proje ekibinin erişimine açık olacaktır.

Bu araştırma sonucunda elde edilecek bilgiler çocukların dil ve bilişsel gelişimi hakkındaki bilgimizi arttırmada etkili olacaktır. Erken yaşta çocukların bağlam içinde verilen sembolik kelimeleri anlamlandırma süreçlerini aydınlatacak ve ket vurma ve dikkat yetisinin bu süreçteki etkisini anlamamıza yardımcı olacaktır. Bu çalışmada elde edilen bilgiler kullanılarak, erken çocukluk döneminde sembolik dil anlama güçlüğü çeken çocuklara yönelik yardım amaçlı yeni stratejiler geliştirilebilecektir.

Araştırmacılar bu çalışmanın herhangi bir zorluk içermediğine inanmaktadırlar. Bu araştırmaya bağlı hiçbir fiziksel ve psikolojik risk yoktur ve rahatsız edici yöntemler

kullanılmaz. Her uygulamada test çeşitleri ve uyarıcılar, çocukların yaşı ve dikkat süresi göz önüne alınarak tasarlanmıştır. Çocukları çok yormamak için her seans esnasında çocuğunuzun ihtiyacı doğrultusunda kısa aralar verilebilecektir. Bütün cümleler, resimler ve testler çocuklar için tasarlanmış olup dikkat dağılmasını önlemek ve çalışmayı eğlenceli hale getirmek hedeflenmiştir. Katılımcı çocuklara cevaplarının doğruluğu hakkında geri bildirim yapılmayacak, sadece katılmalarının önemi övülerek özgüvenlerinin artması sağlanacaktır. Bu projedeki uygulamaların hepsi 4-5 yaş aralığındaki çocukların dil bilgisel, kavramsal, psikolojik ve sosyal gelişimi göz önünde bulundurularak tasarlanmıştır.

Katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz cevaplama işini yarıda bırakmakta serbestsiniz. Eğitimlere devam etmek istemiyorsanız, araştırmacıyla iletişime geçebilirsiniz.

Bu anketi tek seferde tamamlamanız gerekmektedir yoksa cevaplarınız kayıt edilmeyecektir. Çalışmamıza katılmayı kabul ediyorsanız, lütfen aşağıdaki cümleyi okuyup "Evet" kutucuğunu işaretleyerek "İleri" (→) düğmesine basınız. Bu şekilde sayfa sizi ankete yönlendirecektir. Değerli vaktinizi bu çalışmaya ayırdığınız için şimdiden teşekkür ederiz.

ODTÜ Dil ve Bilişsel Gelişim Laboratuvarı İletişim Bilgileri
E-Mail Adresi:
Araştırmacı İletişim Bilgileri:
E-Mail adresi:
Telefon Numarası:

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip bırakabileceğimi biliyorum.

☐ EVET

Q1

Aşağıda demografik bir takım bilgiler sorulmuştur. Tamamladıktan sonra cevaplarınızın kaydedilmesi için diğer sayfaya geçmeyi unutmayınız.

Adınız Soyadınız	
Çocuğunuzun Adı Soyadı	
Çocuğunuzun doğum tarihi (GG/AA/YYYY)	
Çocuğunuzun cinsiyeti:	
Evde konuşulan diller (Türkçe harici başka bir dil konuşuluyor ise):	

C. TURKISH SUMMARY / TÜRKÇE ÖZET

1. GİRİŞ

Sembolik dil kullanımlarından olan metaforlar iki farklı sözcüğün ortak bir anlamı paylaştığını belirtir. Örneğin, *hayat bir yolculuktur* cümlesi hayat ve yolculuk sözcüklerinin ortak olarak paylaştığı bir anlam olduğunu ifade eder. Yapılan bazı çalışmalar metaforların günlük konuşma dilinin önemli bir kısmını oluşturduğunu göstermiştir (Cameron 2003; Martin, 2006; Shutova & Teufel 2010). Bu bilgi göz önünde bulundurulduğunda metaforların anlaşılmasında yaşanan bir sorunun, bireylerin sosyal ve eğitimsel hayatlarında sorunlar doğuracağı söylenebilir. Bu nedenle, metaforların bireyler tarafından nasıl anlamlandırıldığı ve bu süreçte ne gibi faktörlerin etkili olduğunu araştırmak önem arz etmektedir. Alanyazında belirtilen karşıt görüş ve bulgular sebebiyle, metaforların nasıl anlaşıldığı ve ne gibi faktörlerin sürece etkisi olduğu hala net olarak açıklanamamıştır (Öztürk et al., 2020).

Alanyazında yapılan çalışmalar bu konuyu, metaforların nasıl işlendiği, metaforların anlamlandırılmasının gelişimsel modeli ve metaforların anlamlandırılmasının bilişsel yönleri şeklinde farklı bakış açılarından ele almıştır.

İlk olarak, metaforların nasıl işlendiğini araştıran çalışmalar karşıt iki ana model ortaya koymuşlardır. Direkt erişim modeli, bireylerin metaforları gördüğü anda sözcüklerin gerçek anlamlarını düşünmeden direkt olarak ifadenin metaforik anlamına eriştiklerini söylemektedir (Glucksberg, 2008; Glucksberg & Keysar, 1990; Gibbs, 1994; McElree & Nordlie, 1999; Wolff & Gentner, 2000). Öte yandan, dolaylı erişim modeli, bireylerin metaforik ifadeleri öncelikle sözcüklerin gerçek anlamları ile anlamlandırdıklarını ileri sürmektedir. Bu modele göre, bireyler ifadenin gerçek anlamını yanlışlandıktan sonra olası başka metaforik anlamların arayarak ima edilen metaforik anlama erişmektedir. (Davidson, 1978; Gertner & Bowdle; 2008; Grice, 1975; Searle, 1979).

Metaforların anlamlandırılmasını gelişimsel olarak inceleyen çalışmalar ise metafor anlama yetisinin çocuklarda hangi yaşlarda gelişim gösterdiği konusunda karşıt bulgular ortaya koymuştur. Yapılan bazı araştırmalar çocukların 8-10 yaşına kadar metaforları gerçek anlamları ile anladıklarını ve metaforik ifadeleri anlamadıklarını ortaya koymuştur (Asch & Nerlove, 1960; Cometa & Eson, 1978; Elkind, 1969). Bu çalışmaların hepsi metodolojik olarak çocukların konuşma üretimi yapmalarını gerektirmektedir. Daha sonra yapılan çalışmalar, çocukların dil gelişimlerini göz önünde bulundurarak, bu konuyu çocukların dil gelişimlerine uygun yöntemlerle araştırmıştır. Bu çalışmalar, çocukların 4-5 yaşından itibaren dahi metaforik ifadeleri anlamlandırabildiklerini ortaya koymuştur (Hülagü & Özge, 2017; Özçalışkan, 2007; Pouscoulous & Tomosello, 2020).

Bu konuda yapilan bazi çalışmalar ise metaforik ifadelerin anlamlandırılmasında ne gibi dilbilimsel faktör olduğunu araştırmıştır. Bu çalışmalar, metaforların aşinalık seviyelerinin metaforların anlaşılmasında etkili olduğunu ortaya koymuştur. Aşinalık seviyesi yüksek olan metaforik ifadelerin doğrudan metaforik olarak anlamdırılmasının, aşinalık seviyesi düşük olan metaforik ifadelerin metaforik olarak anlamlandırılmasından daha kolay olduğu gösterilmiştir (Glucksberg & Keysar, 1990; Giora, 1997). Aynı zamanda, yeni metaforik ifadelerin aşinalık seviyesi yüksek veya düşük olan kalıplaşmış ifadelere oranla daha zor metaforik olarak anlaşıldığını gösteren çalışmalar vardır. Yeni metaforik ifadelerin ima edilen metaforik anlamlarına erişilmesinin bilişsel bir süreç olduğunu ortaya koymuştur (Gentner & Bowdle, 2001).

Bazı araştırmalar ise metaforik ifadelerin anlamlandırılmasında rol oynayan bilişsel yetileri araştırmıştır. Bu çalışmalar ket vurma yetisi ve işler belek kapasitesinin metaforik ifadeleri anlamlandırma sürecinde etkili olduğunu ortaya koymuştur (Carriedo et al., 2016; Chiappe & Chiappe, 2007; Pierce & Chiappe, 2008). Bireyler bir metaforik ifade ile karşılaştıklarında, ifadenin ima edilen metaforik anlamına ulaşmak için ifadedeki sözcüklerin akla ilk gelen gerçek anlamlarını baskılamak durumundadır. Bu süreç ket vurma yetisi gerektirmektedir. Bu nedenle ket vurma yetisi daha iyi olan bireyler metaforik ifadelerin ima edilen sembolik anlamlarına

daha kolay erişebilmektedir (Chiappe & Chiappe, 2007). Öte yandan, metaforik ifadenin ima edilen sembolik anlamına ulaşmak için, bireyler aynı zamanda sözcüklerin mümkün olan anlamlarını kısa süreli olarak aktive etmeli ve bu bilgileri manipüle ederek ifadenin anlamında en uygun olan anlamı seçmelidir. Bu süreç işler belek yetisini gerektirmektedir. Bu anlamda, işler belek kapasitesi daha yüksek olan bireyler metaforik ifadeleri daha kolayca ve doğru olarak anlamlandırabilmektedir (Chiappe & Chiappe, 2007).

Bildiğimiz kadarıyla alanyazındaki hiçbir çalışma ket vurma ve işler bellek yetilerinin okul öncesi çocukluk döneminde metaforik ifadelerin işlenmesinde nasıl etki gösterdiğini araştırmamıştır. Ayrıca, çalışmaların hepsi metafor işleme sürecinde etkisi olabilecek faktörleri farklı bakış açıları ile tek olarak incelemiştir. Bildiğimiz kadarıyla, faktörlerin birbirleri ile nasıl bir etkileşim içinde olduğunu gösteren bir çalışma yoktur.

Bu alanda Türkçe anadilli bireyler ile yapılan çalışmalar genel olarak korpus analizleri ve diller arası metaforik ifade karşılaştırmalarından oluşmaktadır (Aksan, 2006; Aksan & Kantar, 2008; Arıca-Akkök, 2017). Bu konuyu ruhbilimsel açıdan ele alan çalışmalar da yapılmıştır (Arıca-Akkök & Uzun, 2018; Özkan ve diğerleri., 2020). Ancak, bu çalışmaların hiçbiri metafor algılama sürecine etki eden faktörleri birlikte incelememiştir.

Litaratürdeki çalışmalar incelendiğinde metaforik ifadelerin anlaşılması sürecini etkileyen bir çok faktör olduğu ve bulguların tartışmalı olduğu görülmektedir. Alanyazında, tüm faktörlerin etkisini birlikte incelemiş bir çalışma bulunmamaktadır. Metaforik ifadelerin anlaşılması sürecinde etkisi olan faktörlerin daha iyi anlaşılması açısından tüm faktörlerin birlikte etkileşimini incelemek önem arz etmektedir. Bu bağlamda bu çalışma, anadili Türkçe olan okul öncesi çocukların duygu ve vücut bağlamında oluşturulmuş kalıplaşmış ve yeni metaforik ifadeleri nasıl anlamlandırdıkları ve bu süreçte ket vurma ve işler bellek yetilerinin nasıl bir etkisi olduğunu araştırmayı hedeflemektedir.

Bu çalışma bulguları, deneysel dilbilim, dil gelişimi, ruhdilbilim, okul öncesi eğitimi, dil terapisi, bilişsel bilimler ve bilişsel psikoloji gibi farklı alanlara yeni bakış açıları ve öneriler sunabilecektir.

1.2. Araştırma soruları

2. 4 yaşındaki çocuklar metaforik ifadelerin anlamlarına direkt olarak mı dolaylı olarak mı erişim sağlamaktadır?
3. Kalıplaşmış metaforik ifadelerin aşinalık seviyeleri veya metaforların yeni olmasının ifadelerin anlamlandırılmasına nasıl bir etkisi vardır?
4. Metaforik ifadelerin oluşturulduğu duygu ve vucut bağlamı ifadelerin anlamlandırılmasında nasıl bir etkiye sahiptir?
5. Ket vurma yetisi metaforik ifadelerin anlamlandırılması sürecinde nasıl bir etkiye sahiptir?
6. İşler bellek kapasitesi metaforik ifadelerin anlamlandırılması sürecinde nasıl bir etkiye sahiptir?

2. YÖNTEM

Bu çalışmada çocukların metaforik ifadeleri nasıl anlamlandırdığını değerlendirmek için çocukların yaşları göz önünde bulundurularak dil gelişimlerine göre oyun bazlı sözel olmayan jeste dayalı ve sözel açıklamaya dayalı iki farklı deney kullanılmıştır. Katılımcıların ket vurma ve işler bellek yetileri de farklı deneyler ile değerlendirilmiştir. Çalışmaya katılan tüm çocukların ebeveynlerinden deney öncesi imzalı onay formu alınmıştır.

2.1. Katılımcılar

Antakya Bilge Adımlar Anaokulu'nda eğitim gören anadili Türkçe olan 20 çocuk (Myas= 4:03; Aralık = 4:00-4:08; 9 Erkek) çalışmaya katılmıştır.

2.2. Ölçekler

Çalışmaya katılan çocukların metaforik ifadeleri anlamlandırma yetileri ilk olarak sözel olmayan jeste dayalı bir oyun ile değerlendirilmiştir. Bu deney, aşinalık değeri yüksek dört tane kalıplaşmış metafor, aşinalık değeri düşük dört tane kalıplaşmış metafor ve yeni oluşturulmuş dört tane metafor olmak üzere toplamda 12 tane hareket bildiren metaforik ifade içermektedir. Ayrıca, her ifadede metaforik olarak kullanılan hareket bildiren sözcüklerin gerçek anlamları ile kullanıldığı yedi tane gerçek anlamlı ifade kullanılmıştır. Metaforik ifadelerin aşinalık seviyeleri, çalışma öncesi 70 ebeveyn ile yapılan bir anket çalışması sonucu elde edilmiştir. Bu çalışmada kullanılan yeni metaforik ifadeler ise araştırma ekibi tarafından oluşturulmuş ve anadili Türkçe olan on kişi tarafından anlamlı olup olmadıklarına göre değerlendirilmiştir. Araştırmacı çocukların her birine bu ifadeleri konuşmadan sadece jest ve mimiklerini kullanarak göstermelerini istemiştir. Sözel olmayan jeste dayalı bu aktivite sonrası sözel açıklamaya dayalı ikinci bir aktivite uygulanmıştır. Bu aktivitede sözel olmayan jeste dayalı metafor aktivitesinde kullanılan aynı ifadeler kullanılmıştır ve katılımcılara ne-nasıl soruları sorulmuştur. Örneğin; "*Diyelim ki sen sevinçten uçtun. Sence sevinçten uçmak ne demek? Sevinçten uçmak nasıl olur*?". Her iki aktivite sonunda katılımcıların ifadelere verdikleri jeste dayalı ve sözel açıklamaları gerçek anlam, cevap yok/yanlış cevap ve metaforik anlam olmak üzere üç seviyede kodlanmıştır.

Katılımcıların bilişsel yetilerini ölçen bir takım değrlendirmeler de uygulanmıştır. Ket vurma yetisi değerlendirmek amacıyşa çocuklar için balık flanker deneyi (Christ et al., 2011) ve mutlu-üzgün yüz Stroop deneyi (Yeter et al., 2021) kullanılmıştır. İşler belek kapasitesi değerlendirmesi için ileri doğru sayı dizisi (Wechsler, 1974) ve geriye doğru sayı dizisi (Wechsler, 1974) ile cümle tekrarlama ölçeği (Aksu-Koç et al., 2002) uygulanmıştır.

2.3. Prosedür

Deneylerin hepsi Antakya Bilge Adımlar Anaokulu'nda sessiz bir odada yapılmıştır. Çocuklar tüm deneyleri ayrı olarak tamamlamıştır. Araştırmacı metaforik ifadelerin

anlamlandırılmasını değerlendiren deneyler sırasında katılımcıların cevaplarını video ve ses kaydına almıştır. Ket vurma yetisi değerlendirmeleri bilgisayar ortamında yapılmış olup değerlendirme sonuçları bilgisayar ortamında yüzdelik doğru cevap dilimleri olarak elde edilmiştir. İşler belek kapasitesi değerlendirmelerinde katılımcıların cevapları araştırmacı tarafından değerlendirme sırasında uygulama yapılan kağıt üzerine not alınmıştır.

2.4. Öngörüler

Katılımcıların metaforları anlama sürecinde ifadelerin bağlamları, aşinalık seviyeleri ve katılımcıların bilişsel yetilerindeki farkların etkisi olacağı öngörülmüştür. İfadelerin duygu ve vücut bağlamları ile oluşturulduğu düşünüldüğünde duygu metaforlarının direkt olarak metaforik anlaşılması beklenirken, vücut metaforlarının ifadenin gerçek anlamını öncelikli olarak aktive edeceğini ve bu nedenle dolaylı erişim sağlanacağı öngörülmüştür. Katılımcıların aşinalık seviyesi yüksek kalıplaşmış metaforik ifadeleri anlamlandırma süreçlerinin aşinalık seviyesi düşük ifadelere göre daha kolay olacağı öngörülmüştür. Bu nedenle, katılımcıların aşinalık seviyesi yüksek kalıplaşmış metaforik ifadeleri daha çok metaforik anlamları ile açıklamaları beklenmiştir. Ayrıca, yeni metaforik ifadelerin kalıplaşmış metaforlara göre daha zor anlaşıldığı göz önünde bulundurulduğunda, katılımcıların bu metaforik ifadeleri daha çok gerçek anlamları ile açıklamaları öngörülmüştür. Ayrıca, yetişkinlerde olduğu gibi okul öncesi çocukluk döneminde de ket vurma ve işler belek yetilerinin metaforik ifadeleri anlamlandırmada etkisinin olduğu öngörülmüştür. Bu bağlamda, ket vurma yetisi ve işler belek kapasitesi yüksek katılımcıların metaforik ifadeleri bu yetileri görece daha düşük olan katılımcılara göre daha çok metaforik olarak yorumlamaları beklenmiştir.

3. ANALİZ VE BULGULAR

Elde edilen veriler, bağımlı değişkenler katagorik olduğundan dolayı, multinominal lojistik regresyon yöntemi ile analiz edilmiştir. Sözel olmayan jeste dayalı metafor algılama değerlendirmesi ve sözel metafor açıklama değerlendirmesi için iki ayrı

analiz yapılmıştır. Her bir analiz için bağımlı değişkenler, metafor anlama değerlendirmesinde katılımcıların verdiği cevaplardan (gerçek anlam, cevap yok/yanlış cevap ve metaforik anlam) oluşmuştur. Bağımsız değişkenler ise ifadelerin aşinalık seviyeleri, bağlamları, ket vurma ve işler belek değerlendirme sonuçlarını içermiştir. Bulgular katılımcıların metaforik ifadelerin anlamlarına direkt veya dolaylı erişim izlemelerinin ifadelerin bağlamlarına göre değişkenlik gösterdiğini bulmuştur. İfadelerin bağlamları ve aşinalık seviyeleri ile bilişsel yeti ölçekleri arasındaki etkileşim istatiksel olarak önemli bir sonuç vermediği için modelden çıkarılmıştır. Model oluşturulurken geriye doğru kademeli yaklaşım stratejisi izlenmiştir. Sözel olmayan jeste dayalı metafor algılama değerlendirmesi ve sözel metafor açıklama değerlendirmesinde, katılımcılar duygu metaforlarını vücut metaforlarına oranla daha çok metaforik olarak ifade etmiştir. Öngörülerimizin aksine, yeni metaforlar kalıplaşmış metaforlara oranla daha çok metaforik olarak ifade edilmiştir. Chi kare istatistik analizi sonuçları duygu bağlamındaki yeni metaforların aynı bağlamdaki vücut metaforlarına göre daha çok metaforik olarak algılandığını ortaya koymuştur. Bununla birlikte, aşinalık seviyesi yüksek kalıplaşmış metaforlar aşinalık seviyesi düşük metaforlara göre daha çok metaforik olarak algılanmış olsa da bu fark analiz sonuçlarında istatistiksel olarak önemli bir değer ortaya koymamıştır. Ancak, aşinalık seviyesi düşük kalıplaşmış metaforların aşinalık seviyesi yüksek kalıplaşmış metaforlara göre daha çok yanlış cevap/cevap yok şeklinde yanıtlandığı gözlenmiştir. Bilişsel yetilerin metaforik ifadelerin anlaşılması sürecine etkisi ise iki farklı metafor anlamlandırma deneyine göre farklılık göstermiştir. Sözel olmayan jeste dayalı metafor algılama değerlendirmesinde mutlu-üzgün yüz Stroop deneyi sonuçları istatistiksel olarak önemli bir etki ortaya koymuştur. Bu deneyde daha iyi performans sergileyen katılımcıların metaforik ifadeleri metaforik olarak algılama ihtimalleri artmıştır. Ancak, işler belek kapasitesinin sözel olmayan jeste dayalı metafor algılama değerlendirmesinde istatistiksel olarak önemli bir etkisi gözlenmemiştir. Sözel metafor açıklama deneyinde ise geriye doğru sayı dizisi sonuçlarının istatistiksel olarak önemli bir etkisi olduğu görülmüştür. Geriye doğru sayı dizisi testinde daha iyi performans gösteren katılımcıların metaforik ifadeleri daha çok metaforik olarak

açıkladıkları gözlenmiştir. Ancak, ket vurma yetisinin sözel metafor açıklama deneyinde istatistiksel olarak önemli bir etkisi gözlenmemiştir.

4. TARTIŞMA

Bu çalışmada Türkçe anadilli dört yaşındaki çocukların duygu ve vücut bağlamlarında oluşturulan aşinalık seviyesi yüksek ve düşük olan kalıplaşmış metaforlar ile yeni metaforları nasıl anlamlandırdıkları ve bu sürecin ket vurma yetisi ve işler belek kapasitesi ile ilişkisi araştırılmıştır.

4.1. Çocuklar metaforik ifadelerin anlamlarına direkt olarak mı dolaylı olarak mı erişim sağlamaktadır? Metaforik ifadelerin oluşturulduğu duygu ve vücut bağlamı ifadelerin anlamlandırılmasında nasıl bir etkiye sahiptir?

Bu çalışma bulguları duygu ve vücut metaforlarının farklı şekillerde anlamlandırıldığını ortaya koymuştur. Katılımcılar duygu metaforlarını direkt olarak metaforik ifade ederken, vücut metaforlarını daha çok gerçek anlamları ile ifade etmişlerdir. Bu bulgular Lakoff ve Johnson'nın (1980) kavramsal metafor kuramı ile uyumluluk göstermektedir. Bu kurama göre, soyut bağlamdaki metaforlar (örneğin; *duygu metaforları*) somut bağlamdaki metaforlara göre daha çok metaforik olarak algılanabilmektedir. Duygular gibi soyut kavramlar metaforik olarak kodlanma ve algılanma eğilimindedirler. İnsanlar bu tür soyut kavramları uzaysal düzlemdeki bazı somut hareketler ile algılama eğilimindedirler. Örneğin, ümitsizlik bir konteyner olarak algılanır ve içine düşülebilen bir kavramdır. Bu yaklaşım soyut kavramların metaforik olarak daha hızlı algılanmasını sağlamaktadır. Öte yandan, somut metaforların gerçek anlamları metaforik anlamlarından önce aktive edildiğinden dolayı direkt olarak metaforik olarak anlaşılmayabilmektedirler. Bu bağlamda, bu çalışmanın bulguları kavramsal metafor kuramını destekleyecek sonuçlar ortaya koymuştur. Ayrıca, alanyazındaki çalışmalarda kullanılan metaforik ifadeler somut ve soyut bağlamlarına göre sınıflandırılmamıştır. Bu çalışmada, bağlama dayalı gözlenen bu işlemsel farklılık alanyazında ortaya koyulan tartışmalı sonuçları açıklayabilmektedir.

4.2. Kalıplaşmış metaforik ifadelerin aşinalık seviyeleri veya metaforların yeni olmasının ifadelerin anlamlandırılmasına nasıl bir etkisi vardır?

Bu çalışma kalıplaşmış metaforların aşinalık seviyelerinin metaforların algılanması üzerinde etkisi olduğunu ortaya koymuştur. Metaforik ifadelere verilen metaforik anlam ve gerçek anlam cevapları karşılaştırıldığında, aşinalık seviyesi yüksek ve düşük kalıplaşmış metaforlar arasında istatiksel olarak önemli bir fark bulunmamıştır. Ancak, aşinalık seviyesi yüksek kalıplaşmış metaforların daha çok metaforik olarak cevaplandığı gözlenmiştir. Ayrıca, katılımcılar aşinalık seviyesi düşük metaforik ifadelere aşinalık seviyesi yüksek metaforlara göre daha çok cevapsız bırakmış veya yanlış cevap vermiştir. Bu bulgular, aşinalık seviyesinin metaforların algılanmasına etkisi olduğunu ortaya koymuş ve alanyazındaki çalışmalarla paralellik göstermiştir (Bowdle & Genter, 2005; Jones & Estes, 2006; Dulcinati ve diğerleri., 2014).

Yeni oluşturulmuş metaforlar ise, öngörülenin aksine, kalıplaşmış metaforik ifadelerden daha çok metaforik olarak algılanmıştır. Bu bulgular, alanyazındaki çalışmaların bulguları (Bowdle & Gentner, 2005) ile örtüşmemektedir. Çalışmadaki bu bulgunun, duygu bağlamındaki yeni metaforlardan kaynaklanıyor olduğu düşünülmektedir. Çalışmada kullanılan duygu bağlamındaki yeni metaforlar çocukların oldukça aşina olduğu "mutluluk" ve "üzüntü" duygu durumları ile oluşturulmuştur. Ancak, duygu bağlamındaki kalıplaşmış metaforik ifadelerde "ümitsizlik", "telaş", "keyif" ve "sevinç" gibi çocukların daha az aşina olduğu duygu durum sözcükleri kullanılmıştır. Bu nedenle, katılımcılar yeni metaforlarda kullanılmış olan oldukça tanıdık duygu durumların anlamlarından yararlanarak yeni oluşturulmuş duygu metaforlarını kalıplaşmış duygu metaforlarına göre daha kolayca algılamışlardır.

4.3. Ket vurma yetisi metaforik ifadelerin anlamlandırılması sürecinde nasıl bir etkiye sahiptir?

Bu çalışmadaki bulgular ket vurma yetisinin metaforların algılanma süreçlerinde etkisi olduğunu ortaya koymuştur. Mutlu-üzgün yüz Stroop deneyinde daha iyi

performans gösteren katılımcıların metaforik ifadeleri daha çok metaforik jestler ile ifade ettikleri gözlenmiştir. Bu bulgular, metaforik ifadeyi oluşturan sözcüklerin gerçek anlamlarının baskılanarak mümkün olan diğer sembolik anlamlara erişimlerinde, bireylerin ket vurma yetisinin rol aldığını ortaya koymuştur. Bu sonuçlar, alanyazında yetişkin bireyler ile yapılan çalışma sonuçları ile parallelik göstermektedir (Chiappe & Chiappe, 2007). Ket vurma yetisinin metaforların bağlam ve aşinalık seviyesi değişkenleri ile arasında istatistiksel olarak önemli bir etkileşimi bulunmamıştır. Bunun sebebinin, katılımcı sayısının değişkenler arasındaki etkileşimleri saptamakta yetersiz olmasından kaynaklandığı düşünülmektedir. Buna ek olarak, ket vurma yetisinin etkisi sözel metafor açıklama deneyinde gözlenmemiştir. Bu bulgu, ket vurma yetisinin metafor algılama sürecine etkisi hakkında önemli bir bilgi vermektedir. Sözel olmayan jeste dayalı metafor deneyinde katılımcılar metaforik ifadeler ile karşılaştıklarında, ifadelerin metaforik anlamlarına ulaşabilmek amacıyla sözcüklerin gerçek anlamlarını baskılamak durumundadırlar. Bu nedenle, bu deney metafor algılanma sürecinde birincil adımı temsil etmektedir ve ket vurma yetisi gerektirmektedir. Sözel metafor açıklama deneyi ise jeste dayalı metafor deneyinden sonra katılımcıların aynı ifadeleri sözel olarak açıklanmasını gerektirmektedir. Bu aşamada, katılımcılar önceki aşamada sözcüklerin metaforik anlamlarına zaten erişmiş olduklarından dolayı tekrar bir baskılama yapmak durumunda kalmamaktadırlar. Ancak, bu aşamada katılımcıların sözcüklerin mümkün olan metaforik anlamlarını düşünerek ve konuşma üretimi yapmalıdırlar. Bu süreç, işler belek kapasitesi gerektirmektedir. İşler belek kapasitesinin bu sürece etkisi bir sonraki başlıkta açıklanmıştır.

4.4. İşler bellek kapasitesi metaforik ifadelerin anlamlandırılması sürecinde nasıl bir etkiye sahiptir?

Bu çalışma bulguları işler belek kapasitesinin metaforların algılanma sürecine etkisi olduğunu ortaya koymuştur. Geriye doğru sayı dizisi deneyinde daha iyi performans gösteren katılımcılar sözel metafor açıklama deneyinde daha çok metaforik cevaplar vermişlerdir. Bu durum, katılımcılar sözcüklerin mümkün olan sembolik anlamlarına erişirken sözcüklerin anlamsal özelliklerine dair bilgileri hatırladığı ve manipüle

ettiğini, bu sürecin işler belek kapasitesi gerektirdiğini göstermektedir. Ayrıca, bu aşamada katılımcıların dil üretimi yapması gerekmektedir. Alanyazındaki bulgular, metaforik ifadelerin sözel olarak açıklanmasını gerektiren deneylerde katılımcıların işler belek yetisini kullandığını göstermiştir (Blasko, 1999; Chiappe & Chiappe, 2007). Dil üretiminde işler belek yetisinin doğrudan bir etkisi olduğu göz önünde bulundurulduğunda (Dennis & Cabeza, 2008; Kemper & Sumner, 2001), bu çalışma sonuçları yetişkin bireyler ile yapılan alanyazıdanki çalışmalar ile paralellik göstermektedir (Blasko, 1999; Chiappe & Chiappe, 2007).

Öte yandan, işler belek kapasitesi ile metaforların bağlam ve aşinalık seviyesi değişkenleri ile arasında istatistiksel olarak önemli bir etkileşim bulunmamıştır. Bunun sebebinin, katılımcı sayısının değişkenler arasındaki etkileşimleri saptamakta yetersiz olmasından kaynaklandığı düşünülmektedir.

Ayrıca, işler belek kapasitesinin sözel olmayan jeste dayalı metafor deneyinde önemli bir etkisi saptanmamıştır. Bu bulgu, işler belek kapasitesinin metafor algılama sürecine etkisi hakkında önemli bir bilgi vermektedir. Sözel metafor açıklama deneyi jeste dayalı metafor deneyinden sonra katılımcıların aynı ifadeleri sözel olarak açıklanmasını gerektirmektedir. Bu nedenle, metafor algılama sürecinde ikincil bir adımı temsil etmektedir. Bu aşamada, katılımcıların mümkün olan sembolik anlamlara erişmek için sözcüklerin anlamsal özelliklerini hatırlamaları ve manipüle etmeleri gerekmektedir. Ayrıca, bu aşamada katılımcılar aynı zamanda dil üretimi de yapmalıdırlar. Bu süreç, işler belek yetisi gerektirmektedir. Bu bulgular, işler belek yetisinin metafor algılama sürecinde sözcüklerin sembolik anlamlarının seçilmesi ve ifade edilmesi aşamasında etkili rol oynadığını ortaya koymuştur.

5. SONUÇ

Bu çalışma, okul öncesi çağında dört yaşında Türkçe anadilli çocukların duygu ve vücut bağlamında oluşturulmuş kalıplaşmış (aşinalık seviyesi yüksek ve düşük) ve yeni metaforların nasıl anlamlandırıldığı ve bu süreçte ket vurma yetisi ve işler belek kapasitesinin rolünü araştırmıştır. Somut metaforlar katılımcılar tarafından öncelikli

olarak daha çok gerçek anlamları ile anlamlandırılırken, soyut metaforlar daha çok metaforik anlamları ile anlamlandırılmıştır. Bu bulgu, metafor algılama sürecinde tek bir erişim olmadığını ve metaforik ifadelerin bağlamsal farklılıklarının, bu ifadelerin anlamlandırılması sürecine etkisi olduğunu ortaya koymuştur. Ayrıca, bu çalışmadaki bulgular, okul öncesi çocukluk döneminde bireylerin metaforik ifadeleri anlamlandırırken ket vurma ve işler belek yetilerini kullandığını ortaya koymuştur. Bildiğimiz kadarıyla, bu çalışma, erken çocukluk döneminde bilişsel yetilerin metaforik ifadelerin algılanmasına etkisini araştıran ilk çalışmadır.

6. KISITLAR VE GELECEK ÇALIŞMALAR

Metaforların anlamlandırılması sürecine dil yetilerinin etkisi olduğu bilinmektedir (Rundblad & Annaz, 2010; Huang ve diğerleri., 2015). Bu anlamda, katılımcılara Türkçe İfade Edici ve Alıcı Dil Testi (TİFALDİ) uygulanmıştır. Bunun yanı sıra, katılımcılara yaratıcılık ve zihin kuramı testleri de uygulanmıştır. Bu testler kağıt üzerinde uygulanmış olup, sonuçları araştırmacı tarafından test kağıtlarında kaydedilmiştir. Ancak, elde edilen veriler 6 Şubat, 2023 Kahramanmaraş depremi sebebiyle kaybedilmiştir. Gelecek çalışmaların, bu yetilerin etkilerini de göz önünde bulundurması ve incelemesi önem arz etmektedir. Buna ek olarak, yapılan çalışmada metaforik ifadeler anlamlı cümleler içerisinde katılımcılara sunulmuş olsa dahi, zengin bir bağlamda sunulmamıştır. Gelecek çalışmalar, metaforik ifadeleri zengin bir bağlamda sunabilir. Son olarak, yapılan çalışmalarda ket vurma yetisi ve işler belek kapasitesinin metaforik ifadeleri anlamlandırma sürecine etkisi göz önünde bulundurulduğunda, bu yetilerin geliştirilmesini hedefleyen eğitimlerin metaforların anlamlandırılması yetisine etki etmesi beklenebilir. Bu amaçla, bu çalışmada, katılımcılara altı hafta sürecek olan bir ket vurma yetisi eğitim çalışması uyugulanması planlanmıştır. Eğitim öncesi ve sonrasi metafor anlamlandırma deneyleri ve bilişsel yeti testleri uygulanması planlanmıştır. Eğitimin üçünce haftasında yaşanan deprem sebebiyle veri toplama süreci kesintiye uğramış ve bu nedenle eğitim çalışması sonuçlandırılamamıştır. Gelecek çalışmaların, bu tür bilişsel eğitim programlarının metafor anlamlandırma süreçlerine nasıl bir etkisi olduğunu araştırması önem arz etmektedir.

D. THESIS PERMISSION FORM / TEZ İZİN FORMU

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TEZİN ADI / TITLE OF THE THESIS (**İngilizce** / English): The effect of inhibitory control, working memory and domain on the processing of metaphors in children: A gesture-based study with Turkish speaking preschoolers.

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans** / Master ☒ **Doktora** / PhD ☐

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