

THE ACQUISITION OF TURKISH CAUSAL CONNECTIVES: AN  
EXPERIMENTAL STUDY ON CONTENT AND EPISTEMIC DOMAINS

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BEYZA EREN

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STUDY ON CONTENT AND EPISTEMIC DOMAINS**

Submitted by **BEYZA EREN** in partial fulfillment of the requirements for the degree of **Master of Science in Cognitive Science Department, Middle East Technical University** by,

Prof. Dr. Banu Günel Kılıç  
Dean, **Graduate School of Informatics**

---

Dr. Ceyhan Temürcü  
Head of Department, **Cognitive Science**

---

Prof. Dr. Deniz Zeyrek Bozşahin  
Supervisor, **Cognitive Science Dept., METU**

---

**Examining Committee Members:**

Assoc. Prof. Aslı Kılıç Özhan  
Psychology Dept., METU

---

Prof. Dr. Deniz Zeyrek Bozşahin  
Cognitive Science Dept., METU

---

Prof. Dr. Gülsün Leyla Uzun  
Linguistics Dept., Ankara University

---

**Date:** 26.04.2023



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**Name, Last name: Eren, Beyza**

**Signature : \_\_\_\_\_**

## ABSTRACT

### THE ACQUISITION OF TURKISH CAUSAL CONNECTIVES: AN EXPERIMENTAL STUDY ON CONTENT AND EPISTEMIC DOMAINS

Eren, Beyza

MSc., Department of Cognitive Sciences

Supervisor: Prof. Dr. Deniz Zeyrek Bozşahin

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Children acquire language effortlessly without systematic instruction (Guasti, 2002). In the acquisition process, one of the achievements that take long time for children to reach an adult-like performance is the use of connectives (Cain & Nash, 2011; Oğuz & Özge, 2020). There are very few studies on this subject in Turkish. This study aims to fill this gap via offering an insight into the content and epistemic causal connective acquisition process of children aged 6;5- 8. For this purpose, to test whether there are connectives that children use specific to domains of causality as adults do (Çokal, Zeyrek, & Sanders, 2020); children are given both descriptive (biased for content relations) and argumentative (biased for epistemic relations) tasks. The descriptive task, (picture pairs presenting a causally related short story) is given to the participants to describe what they see. In the argumentative task, participants are supposed to argue which one is the best out of a set of photographs, explaining why (Evers-Vermeul & Sanders, 2011). The same process is applied to adult participants to enable comparison. The data are annotated in terms of whether they present a causal relation in the first step, then their relation domain, and finally, the connective that establishes the relation. The data are analyzed statistically. The results are discussed in the scope of the children's ability to produce content and epistemic causal relations and their preference of connective in these domains in comparison to adults.

Keywords: Causality, Connective acquisition, Discourse annotation, Turkish.

## ÖZ

### TÜRKÇE NEDENSEL BAĞLAÇLARININ EDİNİMİ: TEMEL ANLAM VE GEREKÇELİ ALANLAR ÜZERİNE DENEYSEL BİR ÇALIŞMA

Eren, Beyza

Yüksek Lisans, Bilişsel Bilimler Bölümü

Tez Yöneticisi: Prof. Dr. Deniz Zeyrek Bozşahin

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Her çocuk dili doğrudan bir eğitim olmaksızın zahmetsizce edinmektedir (Guasti, 2002). Edinme sürecinde çocukların yetişkin seviyesinde performansla ulaşması uzun zaman alan kazanımlardan biri de bağlaç kullanımıdır (Cain ve Nash, 2011; Oğuz ve Özge, 2020). Türkçede bu konuda oldukça az sayıda çalışma bulunmaktadır. Bu çalışma, 6;5- 8 yaş arası çocukların temel anlam ve gerekçeli nedensel bağlaç edinim süreçlerine ışık tutarak bu eksikliği gidermeyi amaçlamaktadır. Bu amaç doğrultusunda, yetişkinler gibi çocukların da nedensellik alanlarına özgü kullandıkları bağlaçların olup olmadığını test etmek için (Çokal, Zeyrek ve Sanders, 2020); çocuklara hem betimleyici (temel anlam ilişkisi kurmaya eğilimli) hem de tartışmacı (gerekçeli nedensellik ilişkisi kurmaya eğilimli) görevler verilmiştir. Betimleyici görev (ikili resimlerden oluşan ve bir nedensel ilişki barındıran kısa hikayeler) katılımcılara gördüklerini anlatmaları beklenerek sunulmuştur. Tartışmalı görevde ise, katılımcılardan bir dizi fotoğraftan hangisinin en iyisi olduğunu, nedenini açıklayarak tartışmaları istenmiştir (Evers-Vermeul & Sanders, 2011). Ayrıca karşılaştırma yapabilmek için yetişkin katılımcılara da aynı görevler verilmiştir. Toplanan veri, ilk adımda nedensel bir ilişki gösterip göstermedikleri, ardından ilişki alanları ve son olarak da ilişkiyi kuran bağlaç açısından işaretlenmiştir. Veri istatistiksel olarak analiz edilmiştir. Bulgular, çocukların temel anlam ve gerekçeli nedensel ilişkiler kurma becerileri ve bu anlamlarda kullandıkları bağlaç tercihleri yetişkinlerinkilerle karşılaştırmalı olarak tartışılmıştır.

Anahtar Sözcükler: Nedensellik, Bağlaç Edinimi, Söylem İşaretlemesi, Türkçe.

To My Family

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I also have a wish; I hope that those who will start their graduate life and write a thesis from now on will have a chance to complete this process with pleasure without experiencing extraordinary situations such as pandemics, earthquakes, forest fires, and some crises.



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## LIST OF ABBREVIATIONS

<b>CHILDES</b>	Child Language Data Exchange System
<b>PDTB</b>	Penn Discourse Treebank
<b>OR</b>	Odds Ratio



## **CHAPTER 1**

### **INTRODUCTION**

The scientific interest that leads me to write this thesis is my never-ending curiosity about how children, whom I have had a chance to interact with (for instance, my cousins and my little students), suddenly (just as it seems) start to speak Turkish. However, they do not suddenly start to speak fluently, grammatically, and sensibly. Indeed, it is a process that takes years to master; in spite of the fact that they start to use language at short notice.

Children acquire language effortlessly. Regardless of the language they are exposed to, and its mode of communication as either signed or spoken; all infants are able to perform the acquisition without explicit teaching (Guasti, 2002). This is because language is a cognitive achievement (Bermudez, 2014). As human beings, they all have the capacity to learn language as other cognitive abilities. Thus, theoretically, the language acquisition process should tell us about the way cognition works. Reciprocatively, it should be kept in mind that the way cognition works is supposed to strongly affect the process of acquiring language (Evans & Green, 2006). This point of view makes language acquisition valuable for cognitive science.

#### **1.1. Scope of The Thesis**

During the process of acquiring language, an aspect of children's language usage that is still in the process of developing is their utilization of connectives. The use of connectives is observed in children at early ages speaking different languages (e.g., Aksu-Koç & Slobin, 1985; Cain & Nash, 2011; Evers-Vermeul & Sanders, 2011). However, it is quite far from an adult-like performance. Thus, this makes the question of how the system for acquisition works for connective acquisition piquant and scientifically interesting. Accordingly, connective acquisition studies are relatively rare in this domain, especially in Turkish. There are various types of connectives in terms of both syntactic features and senses they have (discussed in Chapter 2). It is observed that there is a discrepancy in the acquisition timing of different connectives in a language. So, this situation has sparked curiosity to investigate the order of connective acquisition as well as the underlying factors contributing to the order.

It has been suggested in the literature that the order of connective acquisition might be related to the type of discourse relation (such as temporal or causal) that the connective

conveys (e.g., Bloom, Lahey, Hood, Lifter, & Fiess, 1980; Sanders, Spooren, & Noordman, 1993; Spooren & Sanders, 2008). In the scope of causal connectives, it is argued that their order of acquisition would be strongly correlated with their respective relation domains.

All human beings tend to interpret their environments by conveying causal relations (Murray, 1997). Causal relations have different types described in the literature in terms of subjectivity (explained in section 2.1.). Three main domains related to subjectivity are presented by Sweetser (1990): content (real-world causality of an event), epistemic (the cause of a belief or a conclusion), and speech act (explain a speech act). It has been discussed in the literature that content relation is fundamental; thus, cognitively simpler than the other two (see section 2.1.3.). As she proposed, the causality in our cognition is linguistically profiled. All languages in the world (as far as it is known) have various lexical items expressing causal relations. Thus, children would master constructing content relations first, and this would be observable in their language use. Furthermore, the acquisition of causal connectives used in the epistemic domain would take a longer time respectively to the content domain. There are a few studies in European languages such as English, Dutch, and French which support such a hypothesis (discussed in section 2.2.1.). However, there is no comprehensive knowledge about the acquisition of causal connectives in the related literature. This situation is even more limited specifically in the context of Turkish.

## **1.2. Hypothesis, Research Questions, and Aim of the Thesis**

In this thesis, it is hypothesized that as causality and subjectivity are cognitive notions; the acquisition of causal connective used in the epistemic domain would be completed later than the ones used in the content domain in Turkish. Moreover, the order of causal connective acquisition in the content versus epistemic domains in Turkish would correspond to other languages regardless of their typologies; or at least cross-linguistics similarities and differences would show how much the connective acquisition is bound to cognition and how much it is bound to characteristics of a given language. To test the hypothesis, we conducted an experiment with children and adults. The data obtained from adults function as a control group in the evaluation of children's discourses. Moreover, adult language use is considered the ultimate state. Therefore, it enables us to understand how far the language use of a child is from the ultimate level. We have tried to answer the following research questions.

1. Do Turkish speaking children aged 6;5- 8 have a developed ability to construct causal relations as adults?

1.2. Is there a difference in terms of the acquisition of constructing content versus epistemic causal relations?

2. Is there a difference in terms of the acquisition of explicit causal connectives between the content and the epistemic domains?

2.2. Are there connectives they prefer to use specific to one of the domains over the other? If so, is it consistent with the adults' preferences?

Through answering these research questions, we aimed to gain an understanding of causal connective acquisition processes of Turkish speaking children aged 6;5- 8;0. Furthermore, it is expected that the topic and the methodology of the study would bring a fresh perspective to the relevant literature, and pave the way for further studies, particularly in Turkish.

### **1.3. Outline of The Thesis**

The thesis is structured as follows. In Chapter 2, A review on the causality and subjectivity from a cognitive perspective and the literature background of discourse connectives are provided. Specifically, Turkish discourse connectives are identified and studies on connectives are reviewed. Then, we look into the literature on connective acquisition and more specifically the causal connective acquisition in content and epistemic domains. In chapter 3, the data and methodology of the current study are explained in detail. This chapter begins with the description of our material, the data collection process, and the data. It is followed by the annotation cycle of the study: how the annotation is done; the analysis of the inter-rater agreement. The last part of this chapter provides an explanation of logistic regression analysis and how it is implemented in our data. Chapter 4 is the section where the significant distributions in the data and the results of the analyses are shared. Finally, in Chapter 5 conclusions of the study are presented and the results are discussed in the scope of the research questions of the study. Moreover, supplementary observations and limitations of the study are explained; further research is suggested in the chapter.



## CHAPTER 2

### BACKGROUND

In this chapter, we review the relevant literature on causality and subjectivity.

#### 2.1. Causality and Subjectivity

All human beings tend to interpret their environments in the scope of causality (Sanders and Sweetser, 2009). When you see your sister coming home on a rainy day getting wet, you can understand that she has got wet because of the rain; and, when you see your friend crying, you can assume that your friend is experiencing something sorrowful. The causality in this sense is a cognitive principle and it includes subjectivity. In a simple way, we can say that the cause-and-effect relationship between the rain and getting wet in the given example is less subjective than the relation between crying and getting sad. Such domain distinctions, particularly in terms of subjectivity, have been defined as cognitive categories. (Sanders, 2005; Sanders and Sweetser, 2009; Sanders and Spooren, 2009).

Causality and types of subjectivity involved in causality are expressed in all human languages (as in examples 1 and 2). By illustrating subjectivity as a characteristic associated with the speaker, Traugott (1995) defines it as the relationship between the speaker and the speaker's beliefs and attitudes. In discourse, subjectivity is described as the degree to which the conceptualizer, who is the one responsible for the causal link, is present in the utterance. More precisely, it is the amount of speaker involvement (Pander Maat & Degand, 2001; Pander Maat & Sanders, 2001; Spooren, Sanders, Huiskes, and Degand, 2010).

(1) You're wet! You must have been caught in the rain.

(2) I saw him crying. Therefore, he must have experienced something sad.

##### 2.1.1. Causal Connectives

Connectives link two linguistic units which can be words, phrases, or clauses. Discourse connectives, on the other hand, connect discourse-level units (clauses, sentences); thus, connectives used to connect nouns or noun phrases are not discourse connectives and hence they are kept out of the scope of the current thesis. There are three grammatical types of Turkish discourse connectives: coordinating conjunctions, complex subordinators, and anaphoric connectives (Zeyrek & Webber, 2008; Zeyrek,

Demirşahin, Sevdik-Çallı, Ögel-Balaban, & Turan, 2010). Coordinating conjunctions have two subcategories which are simple coordinating conjunctions and paired coordinating conjunctions. (3) is an example of a Turkish simple coordinating conjunction *çünkü* ‘because’. Subordinators are also categorized into two classes as simplex and complex subordinators. There is an instance of *için* ‘for’ that is a complex subordinator (see example 4). It is used with a nominalizing suffix -DI(k) or -mA. The former is used for a causal sense (such as in the second example), whereas the latter provides a sense of purpose.

(3) Ben en soldakini çok sevdim çünkü çok tatlı.

‘I loved the one on the far left because it's so cute.’

(4) Dondurması yere düştüğü için üzülüyor.

‘**Since** her/his ice cream fall on the floor, she/he is upset.’

In addition to such grammatical features, causal discourse connectives are examined in the scope of their directionality (Sanders & Spooren, 2008; 2009). If the first sentence provides a reason whose result is given in the second sentence, the direction of this causal relation is forward. If it is vice versa, it is referred to as backward relation. The forward causal relation is also named as basic order, while the term non-basic order is used for the backward causal relation. Therefore, the forward direction is used and expected to be used more than the other (Çokal, Zeyrek, & Sanders, 2020).

Discourse connectives are also categorized in terms of the senses they convey. The main role of a discourse connective is constructing a coherence relation between sentences or verb phrases. The four fundamental coherence relations that discourse connectives convey are additive, causal, temporal, and contrastive. (e.g., Knott and Sanders 1998; Mann and Thompson 1987; Pander Maat and Sanders 2006). The Penn Discourse Treebank 3.0 (see the next section) presents a sense hierarchy for discourse connectives to annotate them. It has four categories for the first level of annotation: temporal, contingency, comparison, and expansion. Since Contingency is directly associated with our purposes, we explain the senses on the second and third levels of the Penn Discourse Tree Bank sense hierarchy below.

### 2.1.2. Contingency

The Penn Discourse Treebank (PDTB) is a linguistic resource that consists of annotated texts in English Wall Street Journal with information about discourse relations between parts of the text. The PDTB aims to provide a standardized way of identifying and categorizing the ways in which different parts of a text are related to each other in terms of coherence, with a focus on the use of connectives. Turkish

Discourse Bank (TDB) (Zeyrek et al. 2013), is a corpus annotated by following the rules and principles of the PDTB.

The PDTB and the TDB annotate texts by identifying the explicit and implicit connectives that convey discourse relations. Explicit discourse connectives are used to establish a discourse relation (or more) between two clauses or verb phrases (see example 5). When a coherence relation is not established by an explicit connective; however, the relation’s sense can still be inferred and annotated. Thus, we indicate the inferred sense and insert a connective that best paraphrases the sense. This is referred to as the “implicit connective” (as in the sixth example).

(5) Dikkatsiz bir kedi direği görmediği için direğe çarpmış.

‘**Since** the careless cat did not see the pole, she/he hit the pole.’

(CONTINGENCY.CAUSE.RESULT)

(6) Kedi direğe çarpıyor. (Implicit= *Bu yüzden*) Telefonu yere düşüyor.

‘The cat hits the pole. (Implicit= ‘For this reason’) His phone falls to the ground.’

(CONTINGENCY.CAUSE.RESULT)

The two discourse units which are semantically linked with or without a connective are defined as arguments (Prasad et al., 2007; Zeyrek & Webber, 2008). The second argument (Arg2) is the one syntactically bound to the connective. The other argument is described as the first argument (Arg1). In examples 5 and 6, the explicit connective is presented in boldface; the implicit connective is given in parentheses; Arg1 is underlined and Arg2 is double-underlined.

Level-1	Level-2	Level-3
CONTINGENCY	CAUSE	REASON
		RESULT
		NEGRESULT
	CAUSE+BELIEF	REASON+BELIEF
		RESULT+BELIEF
	CAUSE+SPEECHACT	REASON+SPEECHACT
		RESULT+SPEECHACT
	CONDITION	ARG1-AS-COND
		ARG2-AS-COND
	CONDITION+SPEECHACT	-
	NEGATIVE-CONDITION	ARG1-AS-NEGCOND
		ARG2-AS-NEGCOND
	NEGATIVE-CONDITION+SPEECHACT	-
	PURPOSE	ARG1-AS-GOAL
ARG2-AS-GOAL		

Figure 1: PDTB 3.0 Contingency Relation Hierarchy (Webber, Prasad, Lee, & Joshi, 2019)

The PDTB sense hierarchy regarding Contingency is provided in Figure 1 above. When one of two sentences or verb phrases the connective links suggests a reason, explanation, or justification for the other one, the connective is annotated under the Level-1 category of the contingency relation. The contingency relations comprise three kinds of causal relations, four kinds of condition relations, and the purpose relation in the second level, as shown in Figure 1. The PDTB describes a connective as providing a CAUSE relation when it constructs a causal relation between its arguments but is not a conditional one, as in examples 5 and 6. The other two types of causal relations on Level-2 are: CAUSE+BELIEF which refers to a relation sense including a belief (see example 7); and CAUSE+SPEECH ACT which is used when one of the arguments of the relevant relation is conveyed a speech act linked to the other argument in a causal way.

Furthermore, in PDTB 3, a symmetric relation refers to a discourse relation where the order of the arguments does not affect the meaning or direction of the relation, while an asymmetric relation is one where the order of the arguments does affect the meaning or direction of the relation. Accordingly, the three types of relations described above can be established symmetrically or asymmetrically. These features are annotated in Level-3. In this level, cause relations are described in detail demonstrating their arguments' roles, such as reason or result, i.e., directionality. The relation sense is annotated as REASON when Arg2 provides the reason, and it is annotated as RESULT when Arg2 provides the result. In the parentheses after example 7, all three levels of the causal relation are provided, with a dot between the levels.

(7) The store is closed, so there must be a holiday today.

(CONTINGENCY.CAUSE+BELIEF.REASON)

In this thesis, we annotated the data in terms of CAUSE relations presented in Figure 1. The relations of Condition and Purpose are beyond the scope of the thesis objective.

### 2.1.3. Sweetser's domains

The three types of cause relations in the PDTB contingency hierarchy are theoretically similar to the domain idea suggested by Sweetser (1990). She presented the idea of the domain to address the semantics of several connected events including verbs of perception, modal components, and connectives. She suggested that these linguistic components have evolved into new meanings from their original content meanings in the more subjective epistemic and speech-act domains. Therefore, she stated that the content domain is the simplest one in the scope of cognition.

The first domain is the content domain. Connectives indicate a real-world causality of an event in this domain. Therefore, the content causal domain corresponds to the Level-2 sense CAUSE in PDTB. Accordingly, causal relations in examples 5 and 6

are in the content domain. The second domain is epistemic; connectives are used to provide the cause of a belief or a conclusion in the epistemic domain. The epistemic domain of causality corresponds to the Level-2 sense CAUSE+BELIEF in the PDTB sense hierarchy. Thus, the discourse relation in the seventh example conveys an epistemic causality. Finally, when a connective is used to explain a speech act in a causal way, it is labeled as the speech-act domain which is another Level-2 sense labeled as CAUSE+SPEECH ACT in the PDTB sense hierarchy.

More recently, the domains of causal relations are also classified in terms of the degree of subjectivity as being either objective or subjective instead of content, epistemic, and speech act (Çokal, Zeyrek, & Sanders, 2020; Pander Maat and Degand 2001; Sanders & Spooren, 2009; Sanders & Spooren, 2015; Stukker, 2005). The objective domain refers to the content domain discussed above. The subjective domain covers the epistemic and the speech-act domains in the context of propositional attitudes (Çokal, Zeyrek, & Sanders, 2020).

According to Sweetser, the interpretation of a domain that explains the relation between a pair of clauses does not depend on form but on the information already in someone's cognitive and pragmatic context. In addition, the choice of a connective is not random but is determined by the cognitive and pragmatic context in which the connective is used, such as the speaker's goals, the audience's expectations, and the information that is already known or assumed (Sweetser, 1990). There are several studies and articles that support the idea that language users prefer one connective or lexical item rather than another one to construct a particular domain of causality. Studies in different languages suggest that this idea applies to various languages (see section 2.1.3.). It is claimed that connective preferences provide a window into the speaker's cognitive categorizations of causality (Sanders & Sweetser, 2009).

#### 2.1.4. Findings on Causal Connectives in Content and Epistemic Domains

It is questioned in the literature whether a connective is preferred to others in a specific domain. There are studies with the aim of answering this question in different (mostly European) languages. Sweetser stated that *because* is used in both content and epistemic senses. However, *since* is preferred relatively more often in the subjective domains. Thus, English connectives would not be neatly distinguished in terms of domains (Sweetser, 1990).

A corpus-based (collected from newspapers) study shows that French causal connectives have domain preferences. *Parce que* 'because' is frequently used in the content domain, whereas *car* 'because, for' *puisque* 'since' is chosen to use in the epistemic domain (Degand & Pander Maat, 2003). Another corpus study conducted by Pit (2003) and Wegener (2000) shows that language users in German have also such preferences. When *denn* 'since' is preferred in the subjective/epistemic domain,

*weil* ‘because’ is preferred in the content/objective domain. It is argued that in Dutch, *omdat* ‘because’ and *daarom* ‘that’s why’ are preferred in the content domains, while *want* ‘because, for’ and *dus* ‘so’ are preferred in the epistemic domains. Dutch causal connectives *want* and *omdat* indicate backward causal relations; on the other hand, *daarom* and *dus* mark forward causal relations (Sanders, & Sweetser, 2009; Sanders & Spooren 2013; 2015). A study in Polish was conducted to observe the preferences of *bo* and *to* in causal domains. It shows that both connectives are mostly used in subjective domains. However, *to* is not chosen to present epistemic conclusions without a connective explicitly expressing its cause (Dancygier, 2009).

There are just a few studies that deal with the sensitivity to propositional attitudes of causal connectives in Turkish. The analysis of METU Turkish Corpus by Ruhi (2007) showed that subjective attitude is an important variable in expressing causality. She stated that the use of different connectives in cause-effect segments is preferred in Turkish (Ruhi, 2007, p.153). She observed that *bu/o neden* and *nedeniyle* are used to establish causal relations without involving any objective evaluation or to establish causal relations that express personal attitude/judgement from an objective perspective. This is one of the first statements for Turkish that focuses on connectives specializing in certain domains of causal relations.

Çetintaş-Yıldırım (2015) analyzed how subjective the Turkish case suffixes appear in complex sentences. By looking at the frequency distributions of these case suffixes, the study has demonstrated that they can be systematically arranged based on the subjectivity levels of the complex sentences. In another study of hers, she conducted an analysis of *çünkü* occurrences in Turkish National Corpus, examining the cause-and-effect relationships they establish. The study found that *çünkü* is predominantly used to express real-world events that have occurred or are currently occurring (Çetintaş-Yıldırım, 2016).

Uzun (2018) carried out a corpus study of newspapers and scientific texts in Turkish to investigate the relationship between causal connectives and subjectivity. The study concluded that *bu/o nedenle* ‘for this/that reason’, *nedeniyle* ‘for the reason that’, and *bunun sebebi* ‘the reason for this’ are usually used in the objective/content domain. *Bunun için* ‘for this’ and *-dan dolayı* ‘because of’ are, on the other hand, preferred in the subjective (epistemic/speech-act) domains. All the mentioned connectives are used in forward causal relations. Moreover, it is stated that in cause-effect patterns, it is possible to discern a relationship between subjectivity and causality through the use of connectors in Turkish (Uzun, 2018, p.168).

In another study with a similar aim, Çokal, Zeyrek, and Sanders (2020) analyzed *çünkü* ‘because’ and *için* ‘for’ tokens in Middle East Technical University (METU) Turkish Corpus as well as academic articles in Dergi Park in terms of subjectivity. They argued that in the objective/content causal domain, *çünkü* is preferred over *için* while *için* is

preferred over *çünkü* in the subjective/epistemic domain. However, these preferences are just proportional. There is no such rule or evidence that *çünkü* and *için* always occur respectively in the content domain and the epistemic domain (Çokal, Zeyrek, & Sanders, 2020).

## **2.2. Language and Connective Acquisition**

Regardless of the language they are exposed to, and its mode of communication as either signed or spoken; all infants are able to acquire language effortlessly and without explicit teaching (Guasti, 2002). This is because language is a cognitive achievement (Bermudez, 2014). As human beings, they all have the capacity to learn language as other cognitive abilities. Thus, theoretically, the language acquisition process should tell us about the way cognition works. Reciprocally, it should be kept in mind that the way cognition works is supposed to strongly affect the process of acquiring language (Evans & Green, 2006). This point of view makes language acquisition valuable for cognitive science.

Different aspects of language acquisition have been studied from a cognitive perspective. The use of connectives by children is observed at early ages in different languages (e.g., Cain & Nash, 2011; Evers-Vermeul & Sanders, 2011). Before the age of three, most children develop their first multi-clause discourse (Clark 2002). The coherence relations between these clauses remain implicit in the beginning. After a while, children start to use explicit connectives (Sanders & Spooren, 2009). However, the use of connectives by children is quite far from an adult-like performance. It is questioned in the literature when they master using connectives. Aksu-Koç and Slobin define acquisition as late if it is completed after the age of four. The means of combining clauses to express coherence relations are acquired late. They stated that children tend to rely on the simple juxtaposition of sentences until they are about two years and six months old. At this point, they do not typically use explicit connectives. Over the next year, children begin to incorporate connectives into their language use, particularly those that do not require nominalizations such as conjunctions and converbs. After the age of four, although children start using nominalizations for different subordinate clauses, they still encounter difficulties in distinguishing between the various forms and they may make mistakes in sentence structure. They also stated that there is no systematic data available beyond the age of six to further assess the development of children's use of connectives and nominalizations (Aksu-Koç & Slobin, 1985).

On the other hand, reaching an adult-like performance in connective use varies between certain connectives. Children start to use some connectives earlier than others. One of the aims of connective acquisition studies is to find out the order of the acquisition. Furthermore, a follow-up focus is trying to figure out the reason behind

the order. Bloom's cumulative complexity approach presents an explanation for the order. It is argued that children acquire connectives according to their relation types in the order which is shown as 'additive < temporal < causal < adversative' (Bloom, Lahey, Hood, Lifter, & Fiess, 1980). The reason is that the semantic relations acquired first are easier to process than the later ones. In other words, because of the fact that adversative connectives are semantically more complex than the others, it is acquired last of all.

Intending to reveal the order of connective acquisition, Cain, Patson, and Andrews tested children at the age of 8-10 to investigate their ability to understand coherence relations (additive, causal, temporal, and adversative) in a narrative cloze test. Participants were supposed to select a connective out of the given options to fill in the blank. Results indicated that children only succeeded in the additive relation (Cain, Patson & Andrews, 2005).

Sanders and Spooren expanded Bloom's one-dimensional approach to a multi-dimensional one. They indicate that the order of connective acquisition is not determined by only the relation type but also various other features of connectives such as polarity (Sanders & Spooren, 2008). Thus, cognitively complex connectives are acquired later. Moreover, a connective might indicate more than one sense relation (as discussed in section 2.1.1.), this is a criterion that makes the connective more complex.

In order to be able to produce sentences with causal relations, the ability of understanding causalities should have been developed in the child's mind (Piaget, 1930). Piaget states that children are not able to understand all types of causalities until about the age of seven- eight. As already explained above, causality has two main conceptual domains (see Chapter 2.1.): content/objective, and epistemic/subjective. The acquisition of these domains of causal relations and explicit connectives used to establish the domains are not completed simultaneously. According to Sweetser (1990), since the content domain is prior, and the epistemic and speech-act domains are secondary in the area of causality, content causal relations would be acquired earlier than epistemic causal relations. Verhagen (2000) defines epistemic relations as being more complex than content relations as well. Therefore, the multi-dimensional approach (mentioned above) to the order of connective acquisition claims that content relations, as being simpler than non-content relations, would be acquired first. In the related literature, there are studies on this phenomenon, mostly in European languages. It is expected that the variety of categories in terms of subjectivity in causal relations and connectives would correlate with the pattern of the acquisition of causal relations and connectives.

### 2.2.1. Findings on The Acquisition of Causal Connectives in Content and Epistemic Domains

To investigate the order of causal connective acquisition in the content, epistemic, and speech act domains, Kyratzis (1990) analyzed *because* and *so* expressions in a child corpus. There were three groups of children based on their age. The age range of the first group is 2;4-3.6, the second one is 3;7-6.6, and finally the last one is 6;7-12.0. The results of the study revealed that children tend to use speech act causal relations at a very early age, while the acquisition of epistemic causal relations is delayed, and even the oldest age group of 6;7-years year old use them infrequently (Kyratzis et al.,1990). However, the results were found controversial in terms of the speech-act causal domain because the corpus used in the study is told to be biased to the speech-act causal domain (Evers-Vermeul and Sanders, 2011). Nonetheless, other studies also demonstrate the late acquisition of the epistemic domain of causal connectives.

Zufferey, Mak, and Sanders (2015) aimed to investigate the acquisition of causal relations in French and Dutch-speaking children. They gave written short stories to child participants aged between 5 to 9. Then, children were tested with *why*-questions regarding the given stories. The answers are analyzed in terms of the ability of children to understand causalities in the stories and their acquisition of causal relations and connectives in subjective domains. The results of the study highlighted the role of context in the production of domains of use. Moreover, they stated that children performed consistently lower on evaluations of subjective (epistemic) relations in both languages, compared to objective (content) relations.

Evers-Vermeul studied on a Dutch corpus (in the CHILDES database) of 12 children whose ages are in the range of 1;05-5;06. It is concluded that there is no difference between the emergence of connectives expressing content versus speech act relations. However, the acquisition of epistemic connectives is clearly the latest one out of the three relation types (Evers Vermeul, 2005). Another study with a similar aim was conducted by Spooren and Sanders. They investigated how children aged 6-7 and 11-12 produce causal relations in Dutch. The study examined all sequences of causally related sentences regardless of whether they had connectives. The results showed that the younger group produced more objective causal relations than the older group. They also stated that there was no difference between the two groups in their use of subjective relations, such as speech act and epistemic (Spooren& Sanders, 2008).

The study by Evers-Vermeul and Sanders has formed the starting point for the current thesis. They conducted an experiment on Dutch-speaking children which inspired us to carry out a similar study in Turkish. There were two age groups of children as participants in the study. One group consists of seven children at the mean age of 3;1; the other one has five children at the mean age of 4. They were given three tasks: descriptive, directive, and argumentative. The tasks were biased for the content,

speech-act, and epistemic relations, respectively. The utterances of participants in three tasks were recorded and analyzed. The analysis showed that the number of relations generated per task by 3-year-old and 4-year-old children did not exhibit statistically significant variability. The researchers stated that contexts significantly affect the domain being related. Thus, the domain of the causal relationship is found to vary based upon the task in which it is established. Moreover, they concluded that both participant groups could use connectives in these three domains.

In the same article, the authors present a longitudinal case study where the audio recordings of 12 Dutch-speaking children in the CHILDES database are analyzed to reveal the acquisition order of three domains (content, epistemic, and speech act). The audio recordings comprise the speech of children aged approximately from 1;5 to 3;6 years old. The analysis has been performed on sentences that contain four connectives in the data: *want*, *omdat*, *dus*, and *daarom*. The study concluded that from the age of three, children are able to notice that causal connectives might have domain preferences. It was observed that children used *dus* only in the epistemic domains, while they usually prefer *daarom* in the content domains. Another finding is that although the data are insufficient to reveal the acquisition order of the three causal domains, it demonstrates that the epistemic domain of causality is never the first domain to be acquired (Evers-Vermeul & Sanders, 2011).

### 2.2.2. Turkish causal connective acquisition

To the best of our knowledge, there are just a few studies on connective acquisition in Turkish. In one of the pioneering studies on Turkish language acquisition, Aksu-Koç investigated Turkish-speaking children at the age of 2;0- 4;6 to analyze their developmental process of the expression of cause-effect relations in terms of dependency on context (Aksu-Koç,1978). She stated that the ability to convey cause-effect relationships initially develops in response to inquiries from adults and only subsequently in voluntary verbal expressions. Accordingly, expressions that allow children to build on the prior utterances of adults are acquired earlier.

In a recent study, Oğuz and Özge (2020) examined the acquisition of temporal, causal, and adversative connectives in children aged 8;0- 10;0 and adults. Similar to Cain and Patson, they used a narrative cloze test. It is said in the paper that the adults' performance was almost the same for all connectives. However, children's performance was the best in adversative connectives and the worst in temporal connectives; and they performed a moderate success in causal connectives as compared to adults' proficiency.

To sum up, in this chapter, we have introduced the relevant literature on the causal connective acquisition and dealt with causality from a cognitive perspective to set the ground for the rest of the thesis. In the next chapter, we proceed with the methodology of the thesis.



## CHAPTER 3

### METHODOLOGY

#### 3.1. Materials

This study aims to analyze the causal connective acquisition of children at the age of 6;5- 8;0 in the content and the epistemic domains. For this purpose, we prepared two tasks that are designed after Evers-Vermeul and Sanders' study (2011): the descriptive task and the argumentative task (see section 2.2.1.). In their study, in the descriptive task, a hand puppet asked children to describe the given picture sets. There are causally related three pictures in one picture set. Therefore, the descriptive task is biased for content relations. On the other hand, in the argumentative task, children are given four sets of pictures to choose their favorite among them, and they are asked to convince the hand puppet. Thus, this task is biased for epistemic relations.

##### 3.1.1. The Descriptive Task

For this task, we wrote 12 short stories including causally related events which are assumed to be easy to understand for children and familiar to children. Each short story was drawn by an illustrator for this experiment (see Appendix A). All the illustrations are original. The illustrations were created with an emphasis on adhering to a style and content that is perceived as familiar to children. For instance, *Kedi yürürken telefonuna baktığı için, direğe çarptı ve telefonu düştü.* 'Since the cat was looking at her phone while walking, she hit a pole, and her phone fell.' is illustrated as in Figure 2.

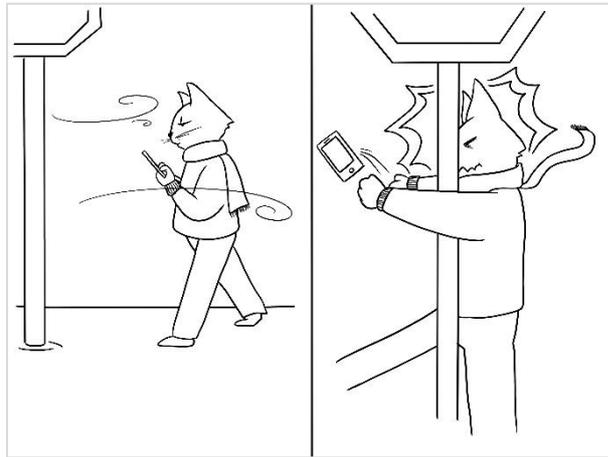


Figure 2: One of the picture sets of the descriptive task, namely the pole.

A pilot experiment was conducted with two children (individually) to test the intelligibility of pictures and picture sets and the causal relations they express. In this experiment, for each causal relation in each picture and between picture sets a *why*-question is asked to the child participants. The children successfully answered all the questions. Thus, it is proved that the pictures and the causal relations they present are comprehensible.

The illustrations of short stories were presented to the participants, and they were instructed to provide a verbal account of their visual observations. The responses they provided for each image are referred to as ‘descriptions’ throughout the rest of the thesis. Each description of participants is annotated and analyzed (discussed in Chapter 4). As a result of the analyses, we expect to find that participants would utter content causal relations in this task. Additionally, it was analyzed whether participants prefer *için* more frequently than *çünkü* in the content domain as observed in the previous studies on adults as reviewed in section 2.1.4.

### 3.1.2. The Argumentative task

In the argumentative task, 3 different photographs belonging to the same category of an object, or an action were presented. The photographs were gathered from open sources (namely Microsoft 365 Open Source and Unsplash), with the primary objective of having the potential to engage children's attention. There were 6 sets of photographs (see Appendix B); one of them is presented as an example in Figure 3.

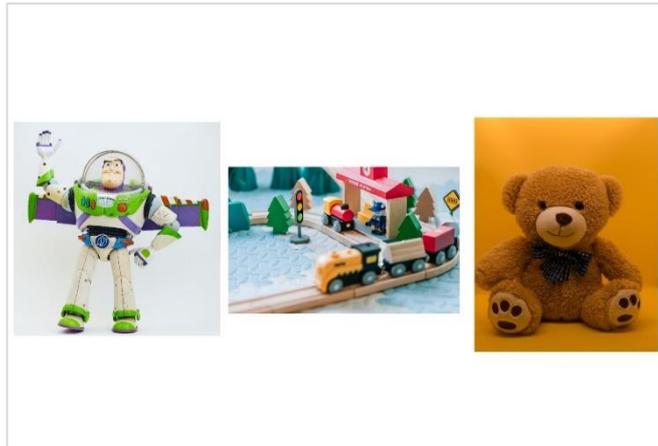


Figure 3: The set of three different toys' photographs that is used in the argumentative task.

The individuals involved in the study were shown these photograph sets one by one. They are instructed to indicate their preferred or favored one out of three, and subsequently provide a rationale for their selection. Each of the responses provided by the participants will be referred to as ‘argumentation’ in the subsequent sections of this

thesis. Each argumentation is annotated and analyzed as well. In this task, it is expected that participants would frequently establish epistemic causal relations and use causal connectives in the epistemic domain. The data collected from this task would show whether they preferred *çünkü* to *için* in consistency with the literature (see Chapter 2.1.4). The performance of children using content causal connectives in the first task, and epistemic causal connectives in the second task will be helpful to understand the developmental process of causal connective acquisition in Turkish.

### **3.2. The Participants, The Procedure, and The Data**

The tasks described above were applied to 30 children between the ages of 6;5 to 8;0 years after their parents had given the consent for their children's participation in the study<sup>1</sup>. All the children were students at the same private school. The experiment was conducted in a room of the school (located in Çayyolu, Ankara) with only the participant and the researcher. The given sets of pictures and photographs were hard-copied versions of the originals. There were two child participants (in addition to 30 children) who couldn't have completed the experiments, because they almost never spoke. Moreover, the same experiment was conducted on 25 adults aged 23;3 to 28;2 to make a comparison. The comparison would help to observe how much developed the ability to use causal connectives of children. The only difference between the way we conducted the experiments on children and adults was the setting. Adult participants were interviewed via an online meeting platform due to the limitation of the issue of distance or time they had for the experiment.

The conversations between the researcher and the participants are audio recorded and manually transcribed. The number of word tokens uttered by participants is given in Table 1. Since the number of child participants (30) is higher than the number of adult participants (25), the frequency rates to the number of participants<sup>2</sup> are also presented in this and the following tables. Both children and adults produced more words in the descriptive task than in the argumentative task. Furthermore, the number of word tokens that adults used are higher than the children's in both tasks.

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<sup>1</sup> The Middle East Technical University Human Research Ethics Committee has granted approval for the conduction of these experiments under protocol number 0403-ODTÜİAEK-2022.

<sup>2</sup> The ratio of a frequency to the number of participants is calculated by multiplying the frequency value by 100 and then dividing the result by the corresponding number of participants.

Table 1: The distribution of word tokens per tasks and participants, and their ratio to the number of participants.

<b>The Number of Word Tokens</b>	<b>The Descriptive task</b>	<b>The Argumentative Task</b>	<b>Total</b>
<b>Children</b>	5581	2263	7844
Ratio to the number of participants	186,03	75,43	261.4
<b>Adults</b>	6464	4020	10484
Ratio to the number of participants	258,56	160,8	419.3
			<b>18328</b>

### 3.3. Annotation

The data are annotated in order to be able to analyze the causal relations and the connectives that establish these causal relations (if any). The data are annotated by two annotators independently according to the annotation guidelines prepared for this study based on PDTB (Prasad et al., 2007; Webber, Prasad, Lee, & Joshi, 2019; Zeyrek & Webber, 2008) (Appendix C). The first annotator is the researcher of the current thesis, and the second annotator is a bachelor's holder in linguistics. Annotated data were analyzed statistically to make a discussion available afterwards. The annotation process is presented in the next three sections (3.3.1, 3.3.2., 3.3.3.), then the analyses are described and discussed in detail in Chapter 4.

#### 3.3.1. Annotation Cycle

The capacity to comprehend causality is a necessary precondition for the ability to construct sentences containing causal relationships (Piaget,1930). Thus, instead of annotating only the observable causal connectives whether they carry causal sense or not; all utterances in the data were annotated in terms of whether they present a causal relation or not. Then, if there is a causal relation, its connective (or connectives) was annotated whether it is explicit or implicit. Finally, the specific explicit connectives were annotated such as *çünkü*, *bu yüzden*. Thus, the annotations of the study are useful to observe not only which explicit connectives they use in a causal sense (and in two domains of causality), but also how often they use explicit connectives to establish a

causal relation. The annotation cycle is depicted in Figure 4, providing a visual representation of the process. For detailed guidelines, you may refer to Appendix C.

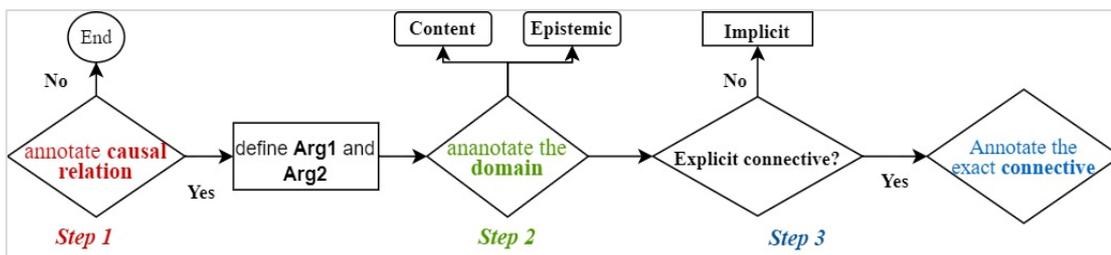


Figure 4: The Annotation Cycle

*First step:* To annotate the data collected from the descriptive task, first, each of the participants’ description to picture pair is transcribed separately. In the first step of the annotation, it is searched whether there is a causal relation or not for each description. In order to determine whether a causal relationship has been established, and to confirm this with certainty, three cues are used: (a) the presence of an explicit connective with a causal sense, (b) in the sentences or verb phrases where causality is implicit, paraphrasing the sentence or phrase with possible connectives with a causal sense, (c) the presence of some verbs that carry a causal sense<sup>3</sup> (Mirza et al., 2014). If the annotator decides that the description expresses a causal relation, Arg1 (the first argument) and Arg2 (the second argument which is syntactically bound to the connective) are specified (Prasad et al., 2007); If there is not, the annotation process ends.

*Second step:* In the second step of the annotation, the domain of the relationship is defined. The categories for the annotation of causal relation domains are *content*, *epistemic*, and *other*. For the annotation of domains, paraphrase tests are used to decide which domain is appropriate to annotate. These tests are useful, especially for challenging cases. The paraphrase test for the content domain is “Situation (x) leads to the fact (y)”; and for the epistemic domain is: “Situation (x) leads me to conclude, surmise or believe (y)” (Çokal, Zeyrek, & Sanders, 2020). The option ‘other’ is supplied in case of a relationship that can be defined as neither content nor epistemic such as speech-act relation.

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<sup>3</sup> Wolff and Song (2003) identified that the concept of causation encompasses three primary types of causal notions, namely CAUSE, ENABLE, and PREVENT, and that these causal ideas are expressed through verbs. Moreover, verbs in the three types in English is presented by Mirza et al. (2014).

*Third step:* Finally in the third step, the annotators check whether the causal relationship is established with an explicit connective. If an explicit connective is not used, they annotate an implicit relation.

If the annotated relation is conveyed by an explicit connective, it is annotated as *explicit*. Then, annotators select the specific connective(s) from a connective list (which is prepared with the expected connectives in the causal sense<sup>4</sup>). When the connective is not available in the list, the annotator adds it to the list and reports the case to the other annotator.

(8) **Child:** Kitabını unuttuğu için ağlıyor.

‘**Since** he forgot his book, he is crying.’

[Content, -DIĞI için, Yes]

(8) is an example of the annotation. The annotations are shown in square brackets. It is annotated as a content causal relation because it directly presents the causality in the picture (see picture 5 in Appendix A) without the participant’s own claim. Then, the connective *-DI(k) için* is annotated. The connective is presented in boldface; Arg1 is underlined and Arg2 is double-underlined.

There is an extra annotation step for only the descriptive task, whether the participant could relate two pictures or not is also annotated (as in example 8 as *Yes*). Therefore, this ability would be the primary reason for not using a causal connective. When this occurred, the researcher provided an explanation that the two pictures were related to each other. The descriptions made by the participants after the explanations were evaluated as elicited cases (see 4.1.).

(9) is an example of this kind of elicited case. The child in this example cannot relate the two pictures first. (The respective picture is presented as the fourth one in Appendix A). Therefore, he/she did not construct a causal relation in his/her description of the picture set. However, after the experimenter provides an explanation, the child was able to construct a causal relation.

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<sup>4</sup> The list is prepared based on the connectives that are annotated in causal sense in the ‘A Lexicon of Turkish Discourse Connectives’ (Zeyrek & Başbüyük, 2019; Stede et al., 2019).

- (9) **Child:** Burada bir teyze kitap okumaya karar veriyor fakat ışık sönük. Öbür taraftaki teyze ışığı yakıyor.

‘Here, an aunt decides to read a book, but the light is off. The aunt on the other side turns on the light.’

[No, -, No]

**Experimenter:** Bu iki resim birbiriyle ilişkili. Bunu bir hikaye kitabı gibi düşünebilirsin. Bu durumda tekrar anlatır mısın gördüklerini?

‘These two pictures are related to each other. You can think of it like a storybook. In this case, can you tell me again what you see?’

**Child:** İlk önce kitap okumaya karar verir sonra ışık olmadığı için ışığı açar.

‘First, she decides to read the book, then she turns on the lights since there is no light.’

[Content, -DIĞI için, Yes]

The annotation procedure of the data collected from the argumentative tasks is quite similar to the data from argumentative tasks. Each argumentation instead of description is separated, then they are annotated according to the same guideline except for the additional step which is the ability to relate given two pictures. In example 10, the argumentation is annotated as presenting an epistemic causal relation, by using *bu yüzden*.

- (10) **Adult:** Sondaki adam kendini bu şarkıya oldukça adanmış gibi duruyor. Çok içten ve aynı zamanda söylemekle kalmıyor üstüne bir de gitar çalıyor bu yüzden sonuncuyu seçeceğim.

‘The guy at the end seems quite dedicated to this song. He not only sings it with great sincerity but also plays the guitar. That's why I will choose the last one.’

[Epistemic, bu yüzden]

### 3.3.2. Hard Cases

We faced some ambiguous cases during the annotation. For each case, a decision is made, and the guideline is updated accordingly. Thus, all data are annotated again after each update. Solutions are decided based on PDTB 3.0. Annotation Manual.

The ambiguous cases were mostly about the usage of multiple explicit connectives for one causal relation. These instances were discussed under two main categories: the use of two different connectives, and the use of the same connectives twice. For the former case, it is decided to annotate them separately following the PDTB principles, as in example 11. This decision was made according to PDTB 3.0. When two or more explicit connectives are used to establish a discourse relation, PDTB 3.0 annotates each of them separately.

- (11) **Adult:** a. En iyi oyuncak bence Buzz light year çünkü benim için de bir anısı olduğu için.

‘I think the best toy is Buzz Lightyear because it holds a memory for me as well, that’s why.’

[Epistemic, çünkü]

- b. En iyi oyuncak bence Buzz light year çünkü benim için de bir anısı olduğu için.

‘I think the best toy is Buzz Lightyear because it holds a memory for me as well, that’s why.’

[Epistemic, -DIĞI için]

For the latter case, only one annotation was made for the connective that was used twice. Because if two separate annotations were made, it would lead to misleading information about the frequency of certain connective's usage for establishing causal relationships. The only connective that is used twice in one causal relation is *-DIĞI için*, as is shown in the example below.

- (12) **Child:** Burada, sıcak olduğu için eridiği için ağlıyor.

‘Here, she is crying since it is hot since it is melting.’

[Content, -DIĞI için, Yes]

### 3.3.3. Cohen's Kappa

Cohen's kappa ( $\kappa$ ) is used as a way to test the degree of inter-coder agreement. The formula for calculating the kappa coefficient is given in (4) (Cohen, 1960).  $P_o$  is the relative observed agreement, and  $P_e$  is the probability of agreement by chance. Kappa corrects for a rater agreement due to a chance (Cohen, 1960; Artstein & Poesio, 2008).

$$(13) \quad \kappa = \frac{P_o - P_e}{1 - P_e}$$

Three Cohen's kappa analysis is run to determine the degree of inter-rater reliability on conveying a causal relation or not, marking a content or an epistemic relation, and expressing causality with or without a connective in descriptive and argumentative tasks separately.

The analyses were performed using the IBM SPSS software program<sup>5</sup>. The annotations were formatted to comply with the SPSS program requirements, and the Kappa analysis option under 'Descriptive Statistics' was selected. In order to calculate the 'due to chance' values, the analysis was configured to include the "Expected" calculation. The results are shown in Tables 2 and 3.

Table 2: Kappa measures of the discourse annotations collected from the descriptive task.

Cohen's $\kappa$	Children	Adults
<b>Causal relation</b> (provided- unprovided)	0,963	0,905
<b>The domain of the relation</b> (content- epistemic)	0,950	0,694
<b>Explicit connective</b> (yes- no)	0,975	0,965

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<sup>5</sup> The IBM SPSS software platform offers advanced statistical analysis. Released 2021, version number 28.0 is used for Kappa and Logistic Regression analyses for the study.

Table 3: Kappa measures of the discourse annotations collected from the argumentative task.

Cohen's $\kappa$	Children	Adults
<b>Causal relation</b> (provided- unprovided)	0,994	0,967
<b>The domain of the relation</b> (content- epistemic)	0,931	0,745
<b>Explicit connective</b> (yes-no)	0,951	0,920

Tables 2 and 3 demonstrate that Cohen's kappa coefficients for all three variables range from 0.694 to 0.975, indicating that there is generally good agreement between raters. On the other hand, for the annotation "The domain of the relation," in both descriptive and argumentative tasks while annotators show strong agreement with a Cohen's kappa coefficient of 0.950 and 0,931 respectively for children's data; they show slightly weaker agreement with a coefficient of 0.694 (in the descriptive task) and 0,745 (in the argumentative task) for adults' data. According to Landis and Koch (1977), when a kappa value is between 0,6 and 0,8, its strength of agreement is substantial; it is perfect when it is between 0,8 and 1.0. As a result, two of the kappa values are accepted as substantial and the rest are accepted as perfect. Thus, the annotation process was reliable.

After obtaining the results of the kappa analysis, two annotators discussed each disagreed annotation. Then, they reached the gold annotation that consists of agreed annotations. The gold-annotated data was used for all analyses.

### 3.4. Logistic Regression Analysis

Regression analysis is a method for modeling relationships between variables. In a regression analysis, it is tried to retreat from data and explain them with one or more explanatory predictor variables (Rowntree, 1981). Logistic regression analysis is one type of regression analysis. In logistic regression analysis, dependent variables should be categorical and dichotomous (two values), and any kind and number of independent variables are applicable. Binary dependent variables represent two categories indicating that an event has occurred or that a characteristic is present (Huang & Moon, 2013). For instance, 0 stands for *conveying a causal relation*, and 1 stands for *not conveying a causal relation*. Therefore, the annotated data and research questions of the current study are appropriate for logistic regression analysis.

Logistic regression analysis predicts the value of one variable from others by calculating the probability of a group or a participant being involved in one of two categories. The value range for the prediction should be between 0 and 1. Other than

probability, odds are significant for logistic regression, because the outcome is binary. Odds ratio (OR) can be defined as the ratio of the probability of an event occurring ( $P$ ) with the probability of an event not occurring ( $1-P$ ):  $P/(1-P)$ . The equation that is used in calculating logistic regression is given below.

(14)

$$P(Y) = \frac{1}{1+e^{-(b_0+b_1X_1+\varepsilon_i)}}$$

In order to provide a statistical answer to the research questions, the data of the study were modeled as fitting logistic regression specific to each research question (Further details about the models are given in section 4.2.). The analyses were calculated using IBM SPSS. To conduct the analysis, the relevant data was first transformed into a format suitable for SPSS. The variables were assigned values of 0 and 1. The binary logistic regression analysis option was selected under the Regression tab. The data types were defined as "categorical". After assigning a reference point, the analyses were finally made.

To summarize, in Chapter 3, the materials used in the experiment, the data collection procedure, the data annotation process, and the statistical analysis of the annotated data were explained. In the next chapter, we will discuss significant distributions in the data regarding the research questions and present the results of the analyses.



## CHAPTER 4

### RESULTS

#### 4.1. Distributions of Causal Relations, Domains, and Explicit Connectives

Each annotated token in the agreed version of the annotated data is counted, and results are presented in the tables below. Some children couldn't understand they should relate two pictures in the descriptive task. In that case, the experimenter explained to her/him that the two pictures are not isolated but related; and asked her/him to describe them again. On the other hand, in some cases, the experimenter asked "Why?" after the participant answers. The answers to the *why*-questions were also analyzed, but separately from the fundamental analysis. Because the development of causal connectives first appears in responses to questions from adults and only thereafter in spontaneous utterances (Aksu-Koç, 1975). Since it is crucial to track the development of causal connective acquisition. The frequencies of causal relations and explicit connectives which are established in these two situations (after the explanation, and *why*-questions) are given in parenthesis with an '+' in the respective tables. These situations are defined as 'elicited' in this thesis.

Table 4: The frequency of causal relations constructed by children and adults, and their ratio to the number of participants.

	Frequency of causal relations
<b>Child</b>	356 (+206)
Ratio to the number of participants	11,86 (+6,86)
<b>Adult</b>	532 (+33)
Ratio to the number of participants	21,28 (+1,32)

Table 4 presents the data on the frequency of causal relations that are established in descriptive and argumentative tasks for two groups: children and adults. Table 4 clearly shows that adults constructed causal relations at a rate approximately 80% higher than that of children.

Table 5: The frequency of content and epistemic causal relations constructed by children and adults, and their ratio to the number of participants.

	Frequency of content relations	Frequency of epistemic relations
<b>Child</b>	274 (+54)	86 (+152)
Ratio to the number of participants	9,16 (+1,8)	2,89 (+5)
<b>Adult</b>	350 (+20)	182 (+13)
Ratio to the number of participants	14 (+0,8)	7,28 (+0,5)

According to Table 5, both children and adults constructed content relations more frequently than epistemic relations. Moreover, the frequency of causal relations constructed by adults is higher than by children in both domains. The difference between the frequencies of participants increases in the epistemic domain. Another salient point is that the number of elicited causal relations established in the epistemic domain by children. It is the only case in the table where the number of elicited relations is higher than the base frequency. It shows the strong effect of *why*-questions for children in constructing epistemic causal relations.

Table 6: The frequency of expressing causal relations with an explicit connective by children and adults, and their ratio to the number of participants.

	Frequency of expressing causality with an explicit connective
<b>Child</b>	276 (+178)
Ratio to the number of participants	9,2 (+5,9)
<b>Adult</b>	427 (+29)
Ratio to the number of participants	17 (+1)

Table 6 presents the frequencies of expressing causalities with an explicit connective by children and adults, and their ratio to the number of participants. The frequencies consist of all connectives used by participants in two domains of causality and tasks. It demonstrates that adult participants used explicit connectives approximately 1.7 times more than child participants.

We have presented the frequencies of causal relations with an explicit connective produced by children and adults. The following two tables illustrate the distribution of these two classes: whether an explicit connective is used by children or adults to establish a causal relationship or not per domain (content, epistemic) (Table 7 and Table 8).

Table 7: The frequencies of expressing causal relations with and without an explicit connective per domain by children.

<b>Child (N=30)</b>	<b>Expressing causality <u>with</u> an explicit connective</b>	<b>Expressing causality <u>without</u> an explicit connective</b>
<b>Content</b>	213 (+57)	40 (+3)
	84% (+95%)	16% (+5%)
<b>Epistemic</b>	63 (+127)	16 (+28)
	79% (+81%)	21% (+19%)

Table 8: The frequencies of expressing causal relations with and without an explicit connective per domain by adults.

<b>Adult (N=25)</b>	<b>Expressing causality <u>with</u> an explicit connective</b>	<b>Expressing causality <u>without</u> an explicit connective</b>
<b>Content</b>	284 (+20)	51 (+5)
	84% (+80%)	16% (+20%)
<b>Epistemic</b>	143 (+9)	39 (+6)
	78% (+60%)	22% (+40%)

Tables 7 and 8 show that adults used explicit connectives in the content domain approximately 1,3 times more often than children. This distribution difference between adults and children increases to 2,2 times in the epistemic domain. On the other hand, the number of causal relationships established implicitly by adults is 1,2 times higher than that of children in the content domain, and 2,4 times higher in the epistemic domain.

According to the tables, both groups mostly used explicit connectives to construct a causal relation. Although children did not construct causal relations as much as adults (see Table 4), they could use explicit connectives in order to construct a causal relation as much as adults do. To be precise, adults established almost twice as many causal relationships as children did. However, both groups demonstrated comparable performances in the use of explicit connectives to construct causal relations compared to constructing causal relations implicitly. In the content domain, both children and adults used explicit connectives to establish 84% of these causal relations and

implicitly established 16% of them. In the epistemic domain, adults used explicit connectives in 78% of the cases and omitted them in 22% of the cases. For children, a similar distribution is observed, with a slight difference of +1% in using explicit connectives.

Table 9: The list of connectives that children and adults used in a causal sense and their frequencies per domain.

Connective	Children		Adults	
	Content	Epistemic	Content	Epistemic
<b>-Diğİ için</b>	79 (+24)	18 (+11)	115 (+12)	25 (+2)
	2,6 (+0,8)	0,6 (+0,36)	4,6 (+ 0,4)	1 (+0,8)
<b>Çünkü</b>	6 (+17)	32 (+103)	5 (+5)	74 (+5)
	0,2 (+0,5)	1,06 (+3,43)	0,2 (+0,2)	2,96 (0,2)
<b>-İncA</b>	21 (+3)		38 (+1)	1
	0,7 (+0,1)		1,5 (+0,04)	0,04
<b>bu/o yüzden/vesileyle/ sebeple/sayede</b>	12	7 (+8)	26	35 (+2)
	(0,4)	0,23 (+0,26)	1,04	1,4 (+0,08)
<b>sonra/ondan sonra</b>	36 (+5)	3 (+1)	18 (+1)	
	1,2 (+0,16)	0,1 (+0,03)	0,72 (0,04)	
<b>Ve</b>	37(+2)	1 (+1)	33 (+1)	2
	1,23 (+0,06)	0,03 (+0,03)	1,32 (+0,04)	0,08
<b>- İp</b>	12	1	22	1
	0,4	0,03	0,88	0,04
<b>- (y)ken</b>	3 (+3)		3	
	0,1 (+0,1)		0,12	
<b>-ArAk</b>			4	
			0,16	
<b>-Dan dolayı/ ötürü</b>			10	4
			0,4	0,16
<b>-diğİ zaman/ - diğİndA</b>	1		9	
	(0,03)		0,36	

<b>Total</b>	207 (+54)	62 (+124)	283 (+20)	142 (+9)
	6,9 (+1,8)	2,06 (+4,3)	11,32 (+0,8)	5,68 (+0,36)

Table 9 presents the data on the distribution of the most used explicit connectives by children and adults in two different domains: the content domain and the epistemic domain. Adults used connectives more frequently than children in both domains. There were certain connectives used only by adults: *-ArAk* and *-Dan dolayı/ ötürü*. The most frequently used connectives by both participant groups were *çünkü* and *-DIğI için*. Both adult and child participants used *çünkü* quite often in the epistemic domain. On the other hand, *-DIğI için* was more frequently preferred in the content domain by both participant groups. Furthermore, all the tables presented in the current section show that the frequency of connective usage by children varies significantly depending on *why*-questions and additional explanations, especially in the epistemic domain.

#### 4.2. Research Questions and Analyses

Having provided descriptive statistics of our data, we now move on to our research questions and the logistic regression analyses to answer these questions. To recap, this study aims to analyze the causal connective acquisition process of Turkish speaking children aged 6;5- 8. The consensus in the literature points out that the causality principle in cognition varies based on subjectivity (see Chapter 2.1.). The two main domains of causality in terms of subjectivity are content/objective and epistemic/subjective domains. The ability to establish content causality is the first one developed (Sweetser, 1990). Accordingly, it is hypothesized that using explicit connectives in the content domain would be acquired earlier than in the epistemic domain. To test this hypothesis, the data are collected from Turkish-speaking children; because, it has not been analyzed in Turkish up to now. If there is a parallel relationship between the order of acquisition of causal relation domains in Turkish and other studied languages, this would support a general cognitive basis for domains of causal connectives (Çokal, Zeyrek, & Sanders, 2020).

There are four research questions in the study. In order to find the answers to the research questions in the data, the data were modeled in accordance with statistical analysis. In addition to distributions of the annotations, statistical modeling helps to interpret the data in a more efficient, readable way.

*Research question 1:* Do Turkish speaking children aged 6;5- 8 have a developed ability to construct causal relations as adults?

In the descriptive task, the "constructing a causal relationship" annotation of the answers given to 12 pictures each consisting of sets of 2, and the annotations of

"constructing a causal relationship" of the argumentations on 6 photographs consisting of sets of 3 are combined and used as dependent variables: 0= *Non* (no causal relation established), 1= *Yes* (causal relation established). Whether these annotations belong to a child or an adult was determined as the independent variable of the model (0= *child* and 1= *adult*). Table 10 demonstrates the outcome of the analysis.

Table 10: The report of analysis number 1.

	<b>B</b>	<b>Sig</b>	<b>Exp (B) Odds ratio</b>	<b>Lower</b>	<b>Upper</b>
<b>Participant</b> (Child/ Adult)	2,146	<,001	8,551	6,106	11,976

According to Table 10, the coefficient for participants (B = 2.146) was statistically significant (p < .001), indicating that the participant as being either a child or an adult was a significant predictor of whether or not they uttered causal relations. The odds ratio (Exp(B) = 8.551) indicates that adults were 8.551 times more likely to construct causal relations than children. The 95% confidence interval for the odds ratio ranged from 6.106 to 11.976, indicating that the analysis was reasonably confident that the true odds ratio falls within this range.

*Research question 1.2.:* Is there a difference in terms of the acquisition of constructing content versus epistemic causal relations?

The context has a significant impact on the domain of the causal relation that would be conveyed. Descriptive utterances are biased to present content causal relations, whereas argumentative utterances are biased to present epistemic causal relations (Evers-Vermeul & Sanders, 2011). Thus, it is expected from the participants to construct epistemic relations in the argumentative task. On the other hand, it is expected to observe content causal relations in participants' language use that are uttered in the descriptive task. From this perspective, to track the answer to the questions, two statistical analyses were conducted.

Whether or not each participant established an epistemic causal relation (coded as *no=0* or *yes=1*) in the argumentative task was the dependent variable; and the group (categorized as either *child=0* or *adult=1*) to which the participant belonged was modeled as an independent variable for the first analysis (number 1.2.1.). The outcome is presented in Table 11.

Table 11: The report of analysis number 1.2.1.

	<b>B</b>	<b>Sig</b>	<b>Exp (B) Odds ratio</b>	<b>Lower</b>	<b>Upper</b>
<b>Participant</b> (Child/ Adult)	2,986	<,001	19,800	11,099	35,321

Table 11 shows that the independent variable of the participant is significantly related to the dependent variable of constructing epistemic causal relation, as indicated by the significant value of the B coefficient at  $p < .001$ . The OR indicates that the odds of constructing causal relation in the epistemic domain are almost 20 times greater for adults than for children. Moreover, the confidence interval for the OR (11.099-35.321) suggests that the true population odds ratio falls somewhere between these two values with 95% confidence.

A second analysis was necessary to answer the question as mentioned above. Similar to the first one, the dependent variable was the case of whether or not each participant established a content causal relation (coded as  $no=0$  or  $yes=1$ ) in the descriptive task; and the same predictor is used in the analysis 1.2.2 as in the analysis 1.2.1. The outcome of the analysis can be found in Table 12.

Table 12: The report of analysis number 1.2.2.

	<b>B</b>	<b>Sig</b>	<b>Exp (B) Odds ratio</b>	<b>Lower</b>	<b>Upper</b>
<b>Participant</b> (Child/ Adult)	1,409	<,001	4,091	2,860	5,853

The logistic regression model is used to examine the relationship between the participant age group and the likelihood of constructing content causal relations. According to the OR, constructing a content relation is over 4 times greater for adults than for children. The confidence interval for the OR (2.860 - 5.853) suggests that the true population OR falls somewhere between these two values with 95% confidence. Two statistical analyses carried out using the annotated data of the experiments indicate that adults had a higher tendency than children to construct causal relations in both content and epistemic domains, but the effect was more pronounced for the epistemic domain than for the content domain.

*Research question 2.:* Is there a difference in terms of the acquisition of explicit causal connectives between the content and the epistemic domains?

As discussed in subsection 2.2.1., It seems that the acquisition of causal connectives especially in the epistemic domain is not completed till the age of 6. However, it is not certainly known when it is completed, because of the lack of studies. It is aimed to analyze this situation in Turkish.

For this purpose, all the instances where the participants used explicit causal connectives are analyzed in terms of their domain. Accordingly, the dependent value of the model is domain with two categories: content (coded as 1) and epistemic (coded as 0). The covariates are adult (coded as 0) and child (coded as 1) under the title of participants. The results are presented in Table 13.

Table 13: The report of analysis number 2.

	<b>B</b>	<b>Sig</b>	<b>Exp (B) Odds ratio</b>	<b>Lower</b>	<b>Upper</b>
<b>Participant</b> (Child/ Adult)	,530	,005	1,699	1,170	2,468

The data presented in Table 13 indicates that children are 1.699 times more likely to use explicit causal connectives in the content domain instead of the epistemic domain compared to adults. This difference is statistically significant with a B value of 0.530 and a significance level of 0.005. The lower and upper bounds of the OR (1.170 and 2.468, respectively) indicate that we can be 95% confident that the true odds ratio falls within this range. Overall, the findings suggest that age is a meaningful predictor of the domain, with children being more likely to use explicit causal connectives in the content domain compared to adults.

*Research question 2.1.:* Are there connectives children prefer to use specific to one of the domains over the other? If so, is it consistent with the adults' preferences?

Whether connectives specialize in certain domains of causal relations or not is one of the focuses of connective studies in the literature, as mentioned in Chapter 2.1.1. Few studies in Turkish have shown that the phenomenon applies to Turkish (adult language use) as well. It is aimed to test if child participants of this study have such a tendency and moreover, if it is consistent with adults' usage.

Several connectives were used to construct causal relations in two tasks by the participants. However, two of them were obviously used more frequently: *çünkü* and *-Diğİ için*. The analysis was conducted to examine the effect of the type of causality expressed on the selection of one of these two conjunctions. It was examined in the discourse of adult and child participants separately. The domain of causality was modeled as the predictor variable, while the type of connective was modeled as a two-category dependent variable, consisting of *çünkü* and *-Diğİ için*. The results of the analysis (number 2.1.) conducted on adults' data can be found in Table 14, and the results of the analysis (number 2.2.) conducted on children's data are presented in Table 15.

Table 14: The report of analysis number 2.1.

	<b>B</b>	<b>Sig</b>	<b>Exp (B) Odds ratio</b>	<b>Lower</b>	<b>Upper</b>
<b>Domain</b> (content/ epistemic)	4,221	<,001	68,080	24,955	185,733

The results show that the domain of causality significantly predicts the selection of the type of connective ( $p < .001$ ). The OR of 68.080 for the predictor variable (domain)

indicates that participants were 68.080 times more likely to use *çünkü* than *-DIĞI için* when expressing epistemic causality. Accordingly, there is a higher likelihood that they will use *-DIĞI için* when expressing content causality. The lower and upper limits of the odds ratio, 24.955 and 185.733 respectively, suggest a high degree of confidence in the estimate. The statistically significant results indicate that there is a strong relationship between the domain of causality and the choice of connective in the adult participants' discourse.

Table 15: The report of analysis number 2.2.

	<b>B</b>	<b>Sig</b>	<b>Exp (B) Odds ratio</b>	<b>Lower</b>	<b>Upper</b>
<b>Domain</b> (content/ epistemic)	3,153	<,001	23,407	8,516	64,338

The logistic regression analysis of children's data indicates quite similar results. The OR of 23.407 for the predictor variable (domain) suggests that participants were 23.407 times more likely to use *çünkü* than *-DIĞI için* when expressing causality related to epistemic, compared to the content in their language use.

To sum up, both tables show similar results, indicating a strong relationship between the domain of causality and the choice of connective in Turkish discourse. However, the odds ratio for the adults' analysis is much higher, suggesting a stronger effect of the domain of causality on the choice of connective than children.

These results have significant implications for the causal connective acquisition in Turkish. In the next chapter, we discuss these implications and provide further additional insights into the causal connective acquisition of Turkish speaking children aged 6;5-8;0.



## CHAPTER 5

### CONCLUSION AND DISCUSSION

It is stated in various studies and articles in the literature that connectives are acquired later respectively to most other parts of languages. Moreover, the process of mastering the use of connectives takes even longer (eg. Aksu-Koç & Slobin 1985; Cain & Nash, 2011; Oğuz & Özge, 2020). In the scope of causal connectives, it is argued that they are acquired earlier when used in the content domain compared to when used in the epistemic domain (Sweetser,1990). However, studies on this topic are limited in number. Particularly in the context of Turkish, there is a lack of information concerning the comparison of the causal connective acquisition in two domains. This study tried to fill this gap.

It is hypothesized that establishing causal relationships within the epistemic domain would develop later than in the content domain, and the acquisition of explicit causal connectives used in the epistemic domain would be completed later than the ones used in the content domain in Turkish. The hypothesis was tested through searching for answers to these research questions:

1. Do Turkish speaking children aged 6;5- 8 have a developed ability to construct causal relations as adults?
  - 1.2. Is there a difference in terms of the acquisition of constructing content versus epistemic causal relations?
2. Is there a difference in terms of the acquisition of explicit causal connectives between the content and the epistemic domains?
  - 2.2. Are there connectives they prefer to use specific to one of the domains over the other? If so, is it consistent with the adults' preferences?

With the aim of creating a context for both domains of causal connectives that could be used, two tasks were designed (one is biased for content and the other is biased for epistemic relations) for child and adult participants; and their speech was recorded for further analysis. The entire dataset was systematically annotated in three distinct steps: identifying the establishment of causal relationships, determining the domain of these relationships, defining the relationship as being established implicitly or explicitly with a connective, and selecting the specific explicit connective employed. After the Kappa values for the inter-coder agreement were measured, the frequency of established causal relationships and their domains, as well as the types of connectives used, based on the gold annotation, were presented in Chapter 4. Then, statistical

analyses were performed, and the outcomes of the analyses are reported in the following section of Chapter 4.

Both the frequencies in the data and statistical analyses revealed certain findings of the study. Adult participants constructed causal relations more frequently than child participants (as shown in Tables 4, 7, and 8). Thus, the first question is answered as Turkish speaking children aged 6;5- 8 are able to construct causal relations; however, not in an adult-like performance.

The second finding of the study which gives answers to research question 1.2. is that children established both content and epistemic causal relationships, but the frequency of causal relationship establishment in the two domains was lower than that of adults. In particular, they fell far behind adults in establishing causal relationships in the epistemic domain (see Tables 5, 11, and 12).

The third finding that answers research question 2 is that although both groups demonstrated comparable performances in the use of explicit connectives to express causality; compared to adults, children used significantly fewer explicit connectives in the epistemic domain than in the content domain. However, the difference of the explicit connective use in the epistemic domain compared to the content domain was not as high as the difference in constructing causal relations in the epistemic domain compared to the content domain. The findings fundamentally support the hypothesis. Based on the findings presented, it can be concluded that the development of establishing epistemic causal relations of children is markedly inferior to those of adults. Nonetheless, it is notable that when children do establish epistemic causal relationships, their ability to do so using an explicit connective is relatively advanced.

The conclusion is explainable with the multi-dimensional approach of Sanders & Spooren (2008). According to the approach, the complexity of connectives determines the order of their acquisition (as discussed in section 2.1.1.). Complexity in this context points to cognitive complexity. As being prior to cognition, the content domain is simpler than the epistemic domain (Sweetser, 1990). Thus, the approach provides an explanation about the reason why child participants did not construct epistemic causal relations and use causal connectives in the epistemic domain throughout their speech, as much as adult participants do; despite being in the same context.

As indicated in the literature, the preference for using the connectives *çünkü* and *için* based on the domain of subjectivity was observed in adult participants in this study as well. While *çünkü* was used predominantly in the epistemic domain, *için* was similarly used in the content domain (as demonstrated in Table 14). This finding supports the notion that the specialization of connective usage in a particular domain might be attributed to a general cognitive basis. Moreover, the specialized usage of *çünkü* and *için* in subjective domains was investigated in a Turkish child data for the first time in

this thesis. We found that children aged 6;5-8;0 exhibited a similar pattern to adults. However, the frequency of using both connectives, especially *çünkü*, was considerably lower among children compared to adults. Therefore, research question 2.1. is answered by these findings.

In summary, the results of the study are mostly consistent with the previous studies in the related literature. This study shows that Turkish speaking children aged 6;5- 8 are able to construct causal relations in their language use. However, Turkish speaking children's ability to convey epistemic causal relations has not developed well at this age range. Moreover, although they could not use explicit connectives as frequently as adults, the distribution of whether using explicit connectives or not to establish causal connectives per domain was quite similar to adults. On the other hand, while using causal connectives at a level close to adults in the content domain, their performance in the epistemic domain falls short of that of adults (see Tables 7, 8, and 13). This result indicates that the acquisition of Turkish causal connectives in the epistemic domain at the of 6;5-8 has been still developing.

### **5.1. Supplementary Observations**

In addition to these main findings, this study revealed a few supplementary observations. Previous research on the acquisition of causal connectives has revealed that children's initial use of *because* is often limited to responding to *why*-questions and that children gradually acquire the ability to spontaneously produce *because* clauses. Moreover, the ability to answer *why*-questions correctly is accounted as a step in the acquisition process of causal connectives (Aksu-Koç, 1975; McCabe and Peterson, 1997). In this study, it was observed that children provided successful responses mostly using the connective *çünkü* when asked *why*-questions in situations where they did not establish a causal relationship themselves.

Another significant observation is about the responses given by children to *why*-questions. The case of *why*-questions could be interpreted as supporting another theory, namely the operating principles of Aksu-Koç and Slobin. In the context of language acquisition, operating principles are the strategies or principles of perception, production, and analysis of speech that are part of children's initial equipment for language acquisition. These strategies or principles are formulated as self-instructions because they guide the child's own learning and are not necessarily taught explicitly by parents or other caregivers (Peters, 1985; Aksu-Koç & Slobin, 1985). One of the strategies is reliance on situational support. It says, "Presuppose as much relevant propositional content as possible, either from the situational or the linguistic context; proceed onwards using local cues you may have picked from the presupposed material." (Aksu-Koç & Slobin, 1985, p.874). It leads a child to assume that the listener already knows certain information or context and uses this assumption to

facilitate their speech production and allow for the economy in their language use. In the argumentative task, children were often asked “Why?” after their responses. The reason for that, when asked to choose the best photograph among the ones presented and explain the reason for the choice, children mostly responded by either simply stating the name of the object/person in the selected photograph with a single word or even only pointing to the photograph of their choice as in example 14.

(14) **Experimenter:** Sana göstereceğim fotoğraflardan en iyisini veya senin favorini seçmeni ve nedenini açıklamanı rica ediyorum.

‘I ask you to choose the best or your favorite of the photographs and explaining why.’

**Child:** Bu. (*pointing to the photograph in the middle.*)

‘This’.

It can be concluded that the reason why children give such answers is that they rely on situational support and facilitate their utterances as much as possible. Instead of saying "The best toy is the one in the middle, that is the train.", they prefer to say only "this". However, what they mean is still clearly understandable because of the context and the previous sentences of the investigator. However, since they did not provide a reason for their choice, it was obligatory to ask the reason.

One of the other observations we would like to share is about the distributions in the data regarding establishing causal relations with an explicit connective or implicitly. The child participants were not as successful as adults in establishing causal relations. Nevertheless, they exhibited a performance similar to that of the adults in using explicit connectives to establish such relations. Semantic transparency as a category of operating principles clarifies this situation. It is stated that marking semantic relations clearly plays a role in facilitating the acquisition process (Aksu-Koç & Slobin, 1985). Thus, using explicit connectives to construct causal relations would provide semantic transparency which facilitates the acquisition process. On the other hand, this observation can be explained by the continuity hypothesis (Murray, 1997; Segal et. al., 1991). An unexpected discourse relation is cognitively complex; thus, requires explicit marking (Hoek et al., 2017). According to the continuity hypothesis, discontinuous relations are unexpected. Moreover, the epistemic/subjective causal relations are discontinuous (Mendes et al., 2023). Accordingly, although children are far behind in establishing causal relationships in the epistemic domain, their frequency of using explicit connectives in the epistemic domain can be explained in this context to be at the same level as adults.

Another observation is about the usage of two connectives mentioned in Chapter 3. It is observed that there were cases where two connectives are used together to establish a causal relation. The connective pairs used together for this purpose are as follows: *çünkü* and *-DIĞI için*; *çünkü* and *o yüzden*. *Çünkü* marks backward causal relations, while *-DIĞI için* and *o yüzden* mark forward causal relations (see section 2.1.1.). According to the continuity hypothesis, discourse relations with backward order are more complex than discourse relations with forward order. Thus, *çünkü* is cognitively more complex than the other two connectives. The usage of multiple connectives was observed 17 times in children and 7 times in adults. One possible reason for using them is the tendency to shift the causal relation to a forward order after using *çünkü*.

The study also presents an observation regarding the connective preferences of children. *Sonra* was used more frequently than *o/bu yüzden* and *-DAn dolayı* to establish causal relations by only children (see Table 9). Although *sonra* primarily carries a temporal meaning, while *o/bu yüzden* and *-DAn dolayı* convey a causal meaning. One of the reasons for this case might be the morphological complexity of *-DAn dolayı*. It is known that children tend to avoid using morphologically complex linguistic units (Aksu-Koç&Slobin, 1985). The higher frequency of using *sonra* may be attributed to its linguistic simplicity (Arg1 – sonra -Arg2) and hence its earlier acquisition. This phenomenon could serve as an example of children's tendency to use linguistic units they have already acquired, instead of employing new and contextually more appropriate linguistic units.

We also have a supplementary observation on multiple senses of discourse relations. Rather than annotating the observable causal connectives, we annotated all utterances in the data based on whether they carry a causal relation or not (this means we also annotated implicitly conveyed relations). Then, we annotated the connectives that anchor the causal relations. We observed some instances where temporal and additive connectives are used in establishing causal relationships. At this juncture, we observed that temporal connectives used in causal relations can be classified into two types in the context of polysemy. We will call them Type-1 and Type-2, as described below.

In Type-1, when a temporal connective is used in a causal relation, the causal relation also contains an implicit causal connective. In other words, this type covers the cases where a causal connective can be added in addition to the explicit temporal connective (as in example 15). On the other hand, in Type-2, where a temporal relation is conveyed by a suffix such as *-IncA*, insertion of an explicit causal connective would be redundant (as in example 16). In such cases, we annotated *-IncA* as conveying a temporal as well as a causal sense, as shown in the example. We only considered the causal sense in the analysis. The frequencies of *sonra* and *-IncA* used in Type-1 and Type-2 by children and adults in our data can be found in Table 15.

(15)

Pencereyi açıyor, (IMPLICIT= **bu nedenle, bu yüzden**) rüzgar esiyor sonra.

'He/She opens the window, (IMPLICIT= for this reason) then the wind blows.'

(16)

Bir ayı çok sıcak olunca, camı açıyor. (sense1: temporal; sense2: causal)

'A bear, when it is too hot, opens the window.'

Table 16: The frequencies of *sonra* and *-IncA* used in Type-1 and Type-2 by children and adults.

	Children		Adults	
	<i>sonra</i>	<i>-IncA</i>	<i>sonra</i>	<i>-IncA</i>
<b>Type-1</b>	32	4	14	10
<b>Type-2</b>	13	20	5	30

## 5.2. Limitations

The study is subject to certain limitations that should be taken into consideration. Firstly, the participant sample size was limited, which may restrict the generalizability of the findings. Secondly, another limitation is the age range (6;5-8;0) of the child participant group. This might impact the results and limit the ability to draw conclusive interpretations specific to the age group.

## 5.3. Further Research

We have left several issues out of the scope of this thesis. For example, we observed that there is a wide range of individual differences affecting connective usage in children depending on their interests outside school such as reading regardless of children's age. Such factors can be taken into consideration in controlled experiments in further research.

We have focused on the content and the epistemic domains of causal relations and connectives. Investigating the acquisition of the speech act domain in addition to the two domains would provide a comprehensive understanding of causal connective acquisition in Turkish. Additionally, examining multiple senses associated with a single connective would be fruitful to observe the acquisition process of discourse relations and connectives in Turkish.

Longitudinal studies tracking children's causal connective acquisition over an extended period would allow for a detailed examination of developmental trajectories. Such studies on the acquisition of the content and the epistemic domain of causal connectives in Turkish would reveal important insights into the patterns and sequences that this thesis couldn't cover.

Finally, we have mentioned our observation on the multiple senses in the previous section. Research in Turkish that annotates multiple senses of the connectives used in establishing causal relations would yield significant insights into the comprehension of the order of causal connective acquisition. We leave the investigation of all this for further research.



## REFERENCES

- A. Aksu-Koç & D. Slobin, The acquisition of Turkish. Reviewed by M. Rispoli, Juniper Gardens Language Project, Kansas City KS, USA. (1989). *Journal of Child Language*, 16(2), 444-446. doi:10.1017/S0305000900010564
- Artstein, R., & Poesio, M. (2008). Inter-coder agreement for computational linguistics. *Computational linguistics*, 34(4), 555-596.
- Bermúdez, J. L. (2014). *Cognitive science: An introduction to the science of the mind*. Cambridge University Press.
- Bloom, L., Lahey, M., Hood, L., Lifter, K., & Fiess, K. (1980). Complex sentences: Acquisition of syntactic connectives and the semantic relations they encode. *Journal of child language*, 7(2), 235-261.
- Cain, K., & Nash, H. M. (2011). The influence of connectives on young readers' processing and comprehension of text. *Journal of Educational Psychology*, 103(2), 429.
- Cain, K., Patson, N., & Andrews, L. (2005). Age-and ability-related differences in young readers' use of conjunctions. *Journal of child language*, 32(4), 877-892.
- Cetintaş-Yıldırım, F. (2015). Subjectivity in complex sentences: The effects of converbs to causal relations. *Dil Eğitimi ve Araştırmaları Dergisi*, 1(1), 1-13.
- Çokal, D., Zeyrek, D., & Sanders, T. J. (2020). Subjectivity and objectivity in Turkish causal connectives? Results from a first corpus study on çünkü and için. *Discourse Meaning: The View from Turkish*, 341, 223.
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20,37–46.
- Dancygier, B. (2009). Causes and consequences: Evidence from Polish, English, and Dutch. In *Causal Categories in Discourse and Cognition* (pp. 91-118). Berlin, New York: De Gruyter Mouton. <https://doi.org/10.1515/9783110224429.91>
- Degand, L., & Pander Maat, H. (2003). A contrastive study of Dutch and French causal connectives on the Speaker Involvement Scale. *LOT Occasional series*, 1, 175-199.

- Enis, Oğuz., & Duygu, Özge (2020). A Developmental Study of the Turkish Connectives. *Dilbilim Araştırmaları Dergisi*, 31(1), 77-100.
- Evans, V., & Green, M. (2006). *Cognitive linguistics: An introduction*. Edinburgh University Press.
- Evers-Vermeul, J. (2005). The development of Dutch connectives: Change and acquisition as windows on form-function relations. Utrecht University.
- Evers-Vermeul, J., & Sanders, T. (2011). Discovering domains—On the acquisition of causal connectives. *Journal of Pragmatics*, 43(6), 1645-1662.
- Fromkin, V., Rodman, R., & Hyams, N. (2013). *An introduction to language*. Cengage Learning.
- IBM Corp. Released 2021. *IBM SPSS Statistics for Windows, Version 28.0*. Armonk, NY: IBM Corp.
- Guasti, M. T. (2002). *Language acquisition: The growth of grammar* (1st MIT Press pbk.ed.). MIT Press.
- Hoek, Jet, Sandrine Zufferey, Jacqueline Evers-Vermeul & Ted J.M. Sanders. 2017. Cognitive complexity and the linguistic marking of coherence relations: A parallel corpus study. *Journal of Pragmatics* 121. 113–131.
- Joshi, A., Prasad, R., Miltsakaki, E., Dinesh, N., Lee, A., Robaldo, L., & Webber, B. (2007). *The Penn Discourse Treebank 2.0 Annotation Manual*. The PDTB Research Group.
- Kehler, A., & Kehler, A. (2002). Coherence, reference, and the theory of grammar.
- Knott, Alistair & Ted Sanders. 1998. The classification of coherence relations and their linguistic markers: An exploration of two languages. *Journal of Pragmatics* 30. 135–75.
- Kyranziz, A., Guo, J., & Ervin-Tripp, S. (1990, August). Pragmatic conventions influencing children's use of causal constructions in natural discourse. In *Annual Meeting of the Berkeley Linguistics Society* (Vol. 16, No. 1, pp. 205-214).
- Landis, J. Richard and Gary G. Koch. 1977. The measurement of observer agreement for categorical data. *Biometrics*, 33(1):159–174

- Li, F. (2014). *Subjectivity in Mandarin Chinese: The meaning and use of causal connectives in written discourse*. Utrecht University.
- Lyons, J. (1977). *Semantics: Volume 2 (Vol. 2)*. Cambridge university press.
- Maat, H. P., & Degand, L. (2002). Scaling causal relations and connectives in terms of speaker involvement.
- Maat, H. P., & Sanders, T. (2002). Subjectivity in causal connectives: An empirical study of language in use.
- Manfred Stede, Tatjana Scheffler and Amália Mendes, « Connective-Lex: A Web-Based Multilingual Lexical Resource for Connectives », *Discours* [Online], 24 | 2019, Online since 30 October 2019, connection on 01 November 2019. URL: <http://journals.openedition.org/discours/10098>; DOI: 10.4000/discours.10098
- Mann, W. C., & Thompson, S. A. (1987). *Rhetorical structure theory: A theory of text organization* (pp. 87-190). Los Angeles: University of Southern California, Information Sciences Institute.
- McCabe, Allyssa, Peterson, Carole, 1997. Meaningful ‘‘mistakes’’: the systematicity of children’s connectives in narrative discourse and the social origins of this usage the past. In: Costermans, J., Fayol, M. (Eds.), *Processing Interclausal relationships: Studies in the Production and Comprehension of Text*. Lawrence Erlbaum Associates, New Jersey, pp. 139–154
- Mendes, A., Zeyrek, D., & Oleškevičienė, G. (2023). Explicitness and implicitness of discourse relations in a multilingual discourse bank. *Functions of Language*, 30(1), 67-91.
- Mirza, P., Sprugnoli, R., Tonelli, S., & Speranza, M. (2014, April). Annotating causality in the TempEval-3 corpus. In *Proceedings of the EACL 2014 Workshop on Computational Approaches to Causality in Language (CAtoCL)* (pp. 10-19).
- Murray, J. D. (1997). Connectives and narrative text: The role of continuity. *Memory & Cognition*, 25(2), 227-236.
- Peters, A. M. (1985). Language segmentation: Operating principles for the perception and analysis of language. *The crosslinguistic study of language acquisition*, 2, 1029-1067.

- Piaget, J., (1930/1970). *The Child's Conception of Physical Causality*. Routledge and Kegan Paul, London.
- Pit, Mirna. 2003. *How to Express Yourself with a Causal Connective: Subjectivity and Causal Connectives in Dutch, German and French*. Amsterdam: Rodopi.
- Rowntree, D. (1981). *Statistics Without Tears: A Primer for Non-Mathematicians*. Penguin.
- Ruhi, Şukriye. 2007. Bu yüz yüzünden [The notion of face]. In Dogan. Aksan & Nalan. Büyükkantarçioğlu (eds.), *Bir bilimlerinden yaşayakalanlar: Prof. Dr. Özcün Başkan'a Armağan [What survives after a scientist: In memory of Prof. Dr. Özcan Başkan]*, 144–158. İstanbul: Multilingual Yayınevi
- Sanders, T. (2005, November). Coherence, causality and cognitive complexity in discourse. In *Proceedings/Actes SEM-05, First International Symposium on the exploration and modelling of meaning* (pp. 105-114). Toulouse: University of Toulouse-le-Mirail.
- Sanders, T. J., & Spooren, W. P. (2015). Causality and subjectivity in discourse: The meaning and use of causal connectives in spontaneous conversation, chat interactions and written text. *Linguistics*, 53(1), 53-92.
- Sanders, T. J., Mak, W. M., & Kleijn, S. (2021). Causality, subjectivity and mental spaces: Insights from on-line discourse processing.
- Sanders, T. J., Spooren, W. P., & Noordman, L. G. (1993). Coherence relations in a cognitive theory of discourse representation.
- Sanders, T., & Spooren, W. (2009). Causal categories in discourse: Converging evidence from language use. *Causal categories in discourse and cognition*, 205-246.
- Sanders, T., & Spooren, W. (2009). The cognition of discourse coherence. *Discourse, of course*, 197-212
- Sanders, T., & Spooren, W. (2013). Exceptions to rules: a qualitative analysis of backward causal connectives in Dutch naturalistic discourse. *Text & Talk*, 33(3), 377-398.
- Sanders, T., & Sweetser, E. (2009). Introduction: Causality in language and cognition what causal connectives and causal verbs reveal about the way we think. In *Causal categories in discourse and cognition* (pp. 1-18). De Gruyter Mouton.

- Sanders, T., & Sweetser, E. (Eds.). (2009). Causal categories in discourse and cognition (pp.20-59). Berlin: Mouton de Gruyter.
- Sanders, T., Sanders, J., & Sweetser, E. (2009). Causality, cognition and communication: A mental space analysis of subjectivity in causal connectives. *Causal categories in discourse and cognition*, 44, 19.
- Santana, A., Nieuwenhuijsen, D., Spooren, W., & Sanders, T. (2017). Causality and subjectivity in Spanish connectives: Exploring the use of automatic subjectivity analyses in various text types. *Discours. Revue de linguistique, psycholinguistique et informatique. A journal of linguistics, psycholinguistics and computational linguistics*, (20).
- Smith, C. S. (2003). *Modes of discourse: The local structure of texts* (Vol. 103). Cambridge University Press.
- Spooren, W., & Sanders, T. (2008). The acquisition order of coherence relations: On cognitive complexity in discourse. *Journal of pragmatics*, 40(12), 2003-2026.
- Spooren, W., Sanders, T., Huiskes, M., & Degand, L. (2010). Subjectivity and causality: A corpus study of spoken language. *Empirical and experimental methods in cognitive/functional research*, 241-255.
- Stukker, N., Sanders, T., & Verhagen, A. (2009). Categories of subjectivity in Dutch causal connectives: a usage-based analysis. *Causal categories in discourse and cognition*, 119-171.
- Sweetser, E. (1990). *From etymology to pragmatics: Metaphorical and cultural aspects of semantic structure* (Vol. 54). Cambridge University Press.
- Traxler, M. J., Bybee, M. D., & Pickering, M. J. (1997). Influence of connectives on language comprehension: Eye tracking evidence for incremental interpretation. *The Quarterly Journal of Experimental Psychology Section A*, 50(3), 481-497.
- Traugott, C. Elizabeth. 1995. Subjectification in grammaticalization. In Dieter Stein & Susan Wright (eds.), *Subjectivity and subjectivisation: Linguistic perspective*, 31–54. Cambridge: Cambridge University Press.
- Uzun, Leyla. 2018. Neden bağlayıcılarının öznellik ile ilişkisi Türkçe yazılı derlem tabanlı bir tartışma [A corpus-based study on the relationship of causal connectives with subjectivity in Turkish]. In Yeşim Aksan & Mustafa Aksan (eds.), *Türkçe’de yapı ve işlev: Şükriye Ruhi armağanı* [Structure and function in Turkish: In memory of Şükriye Ruhi], 145–170. Ankara: BilgeSu Yayıncılık.

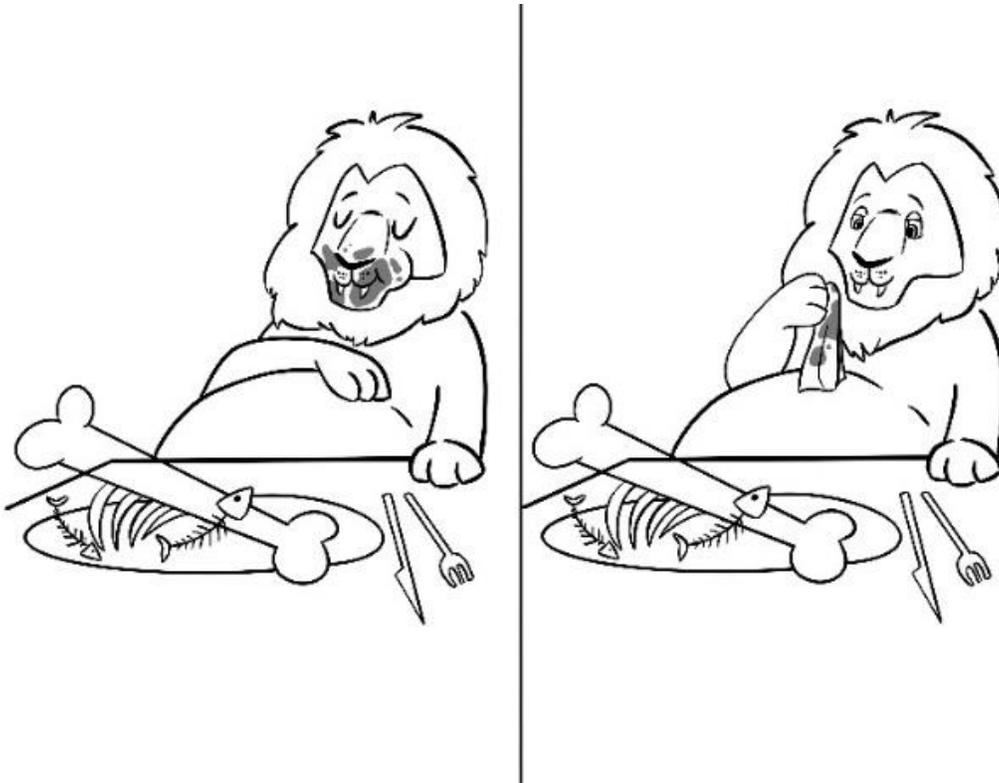
- Verhagen, Arie, 2000. *Achter het Nederlands. Over interacties tussen taal en achtergrondcognitie* [Beyond Dutch: on interactions between language and background cognition]. Inaugural Speech, Leiden University.
- Webber, B., Prasad, R., Lee, A., & Joshi, A. (2019). *The Penn discourse treebank 3.0 annotation manual*. Philadelphia, University of Pennsylvania, 35, 108.
- Zeyrek, D., & Başbüyük, K. (2019, August). *TCL-A lexicon of Turkish discourse connectives*. In *Proceedings of the First International Workshop on Designing Meaning Representations* (pp. 73-81).
- Zeyrek, D., & Webber, B. (2008). *A discourse resource for Turkish: Annotating discourse connectives in the METU corpus*. In *Proceedings of the 6th workshop on Asian language resources*.
- Zeyrek, D., Demirsahin, I., Sevdik-Calli, A. B., Balaban, H. Ö., Yalçinkaya, İ., & Turan, U. D. (2010, July). *The annotation scheme of the Turkish Discourse Bank and an evaluation of inconsistent annotations*. In *Proceedings of the fourth linguistic annotation workshop* (pp. 282-289).
- Zufferey, S. (2012). "Car, parce que, puisque" revisited: Three empirical studies on French causal connectives. *Journal of Pragmatics*, 44(2), 138-153.
- Zufferey, S., Mak, W. M., & Sanders, T. J. (2015). *A cross-linguistic perspective on the acquisition of causal connectives and relations*. *International review of pragmatics*, 7(1), 22-39.

## APPENDICES

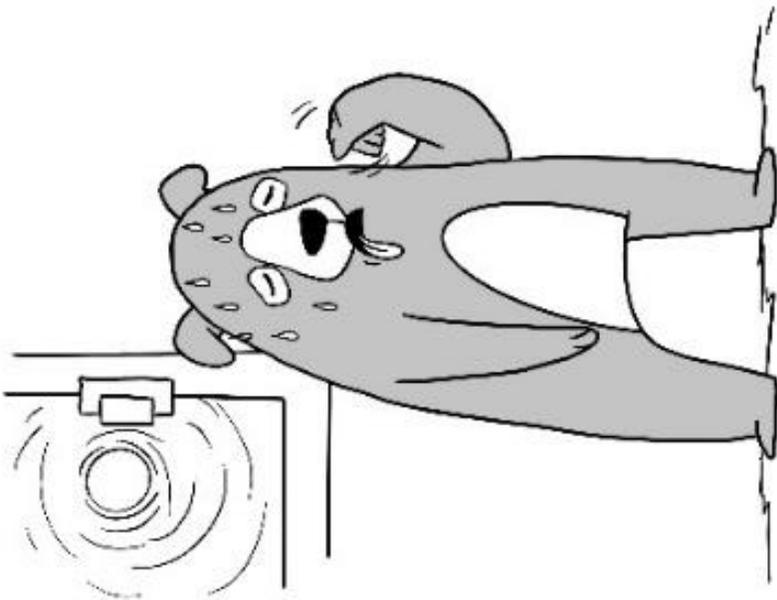
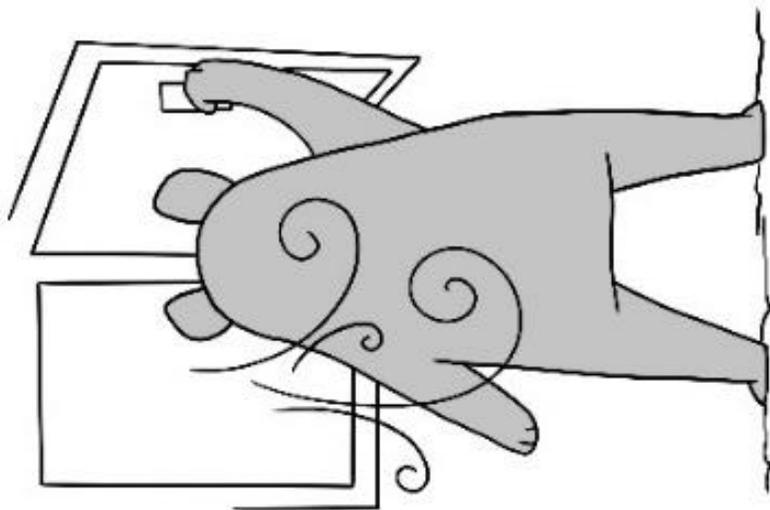
### APPENDIX A

#### The Materials of The Descriptive Task

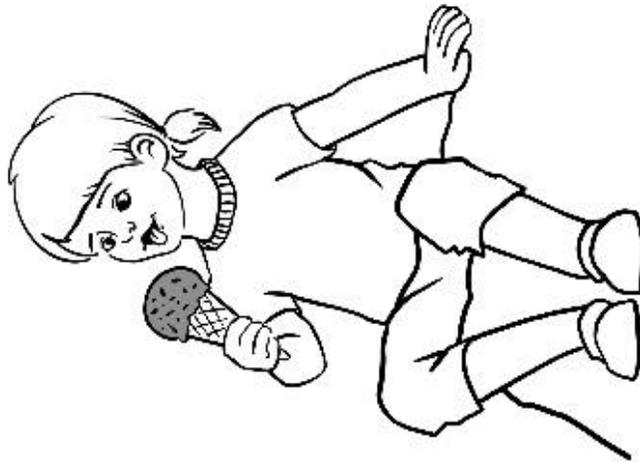
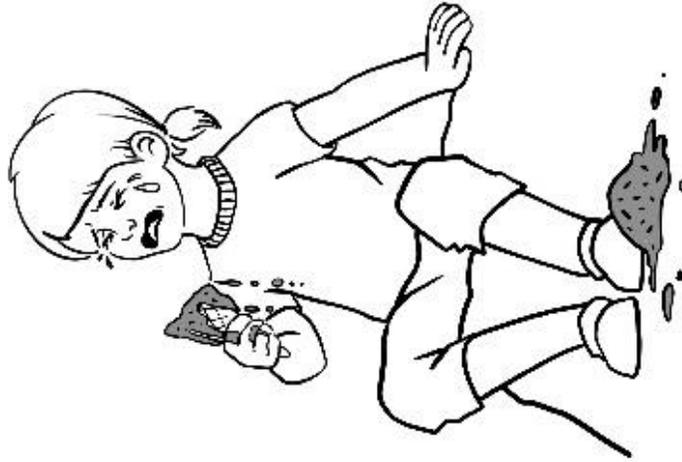
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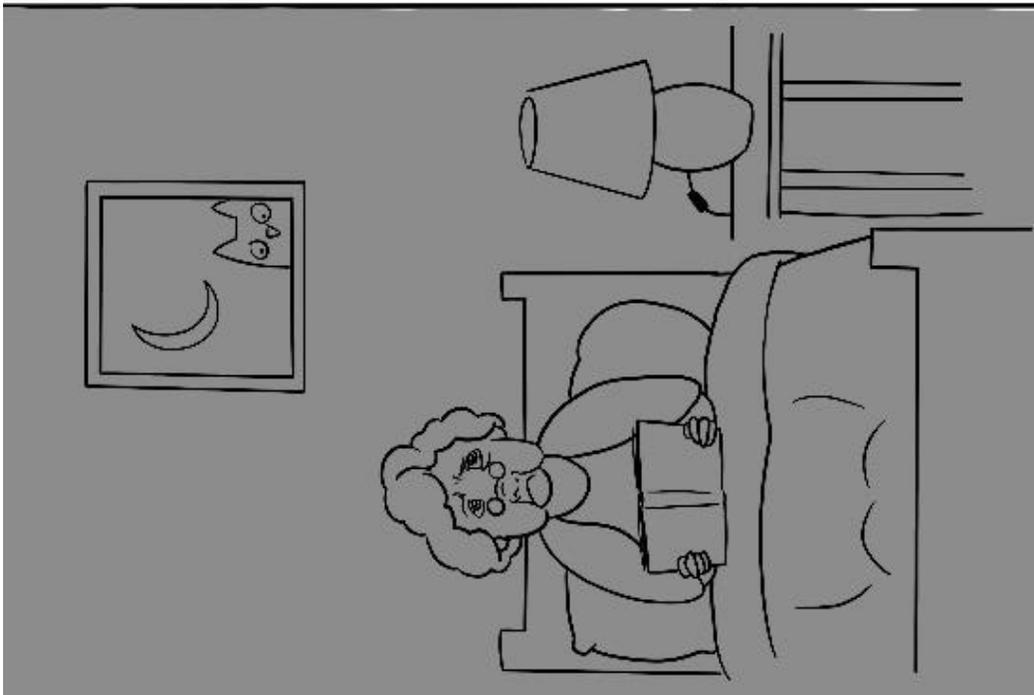
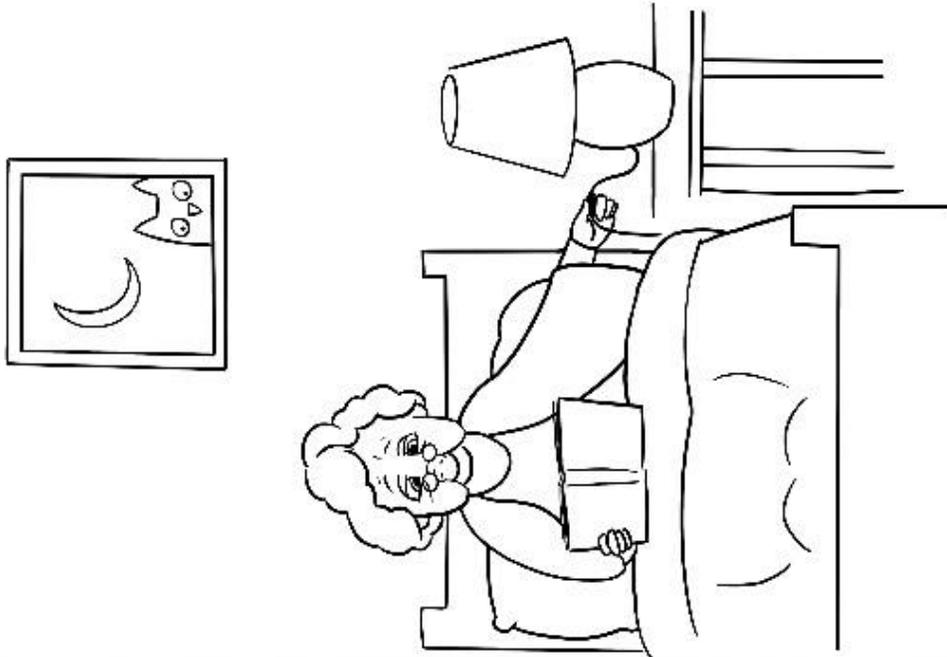
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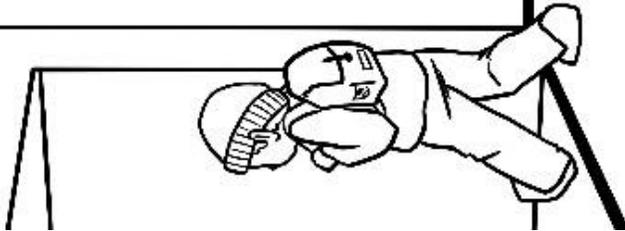
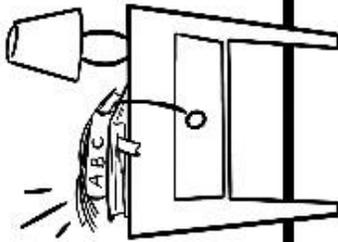
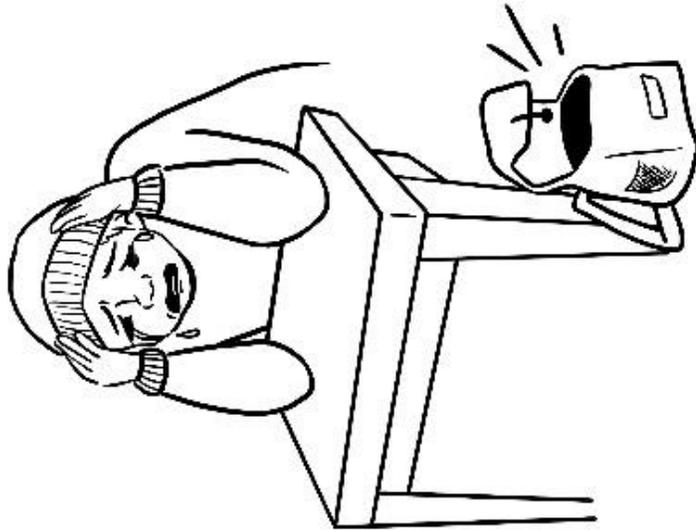
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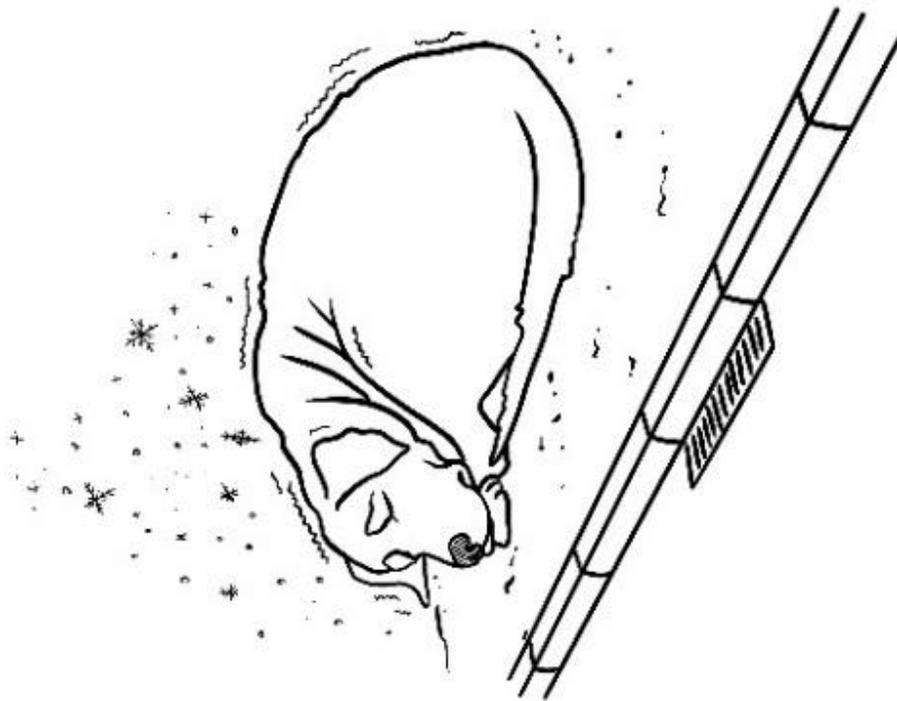
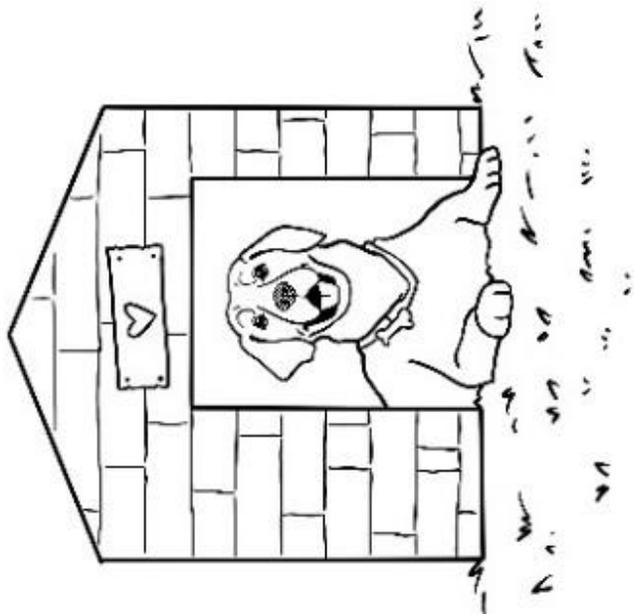
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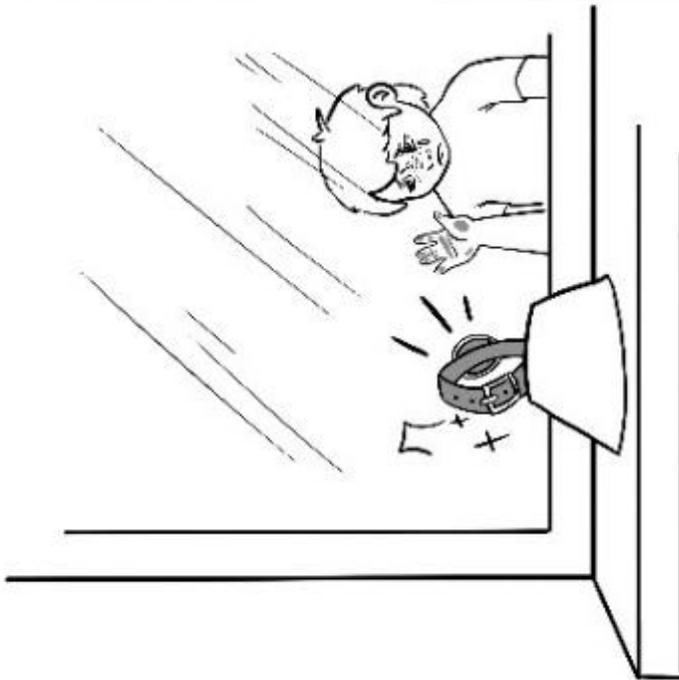
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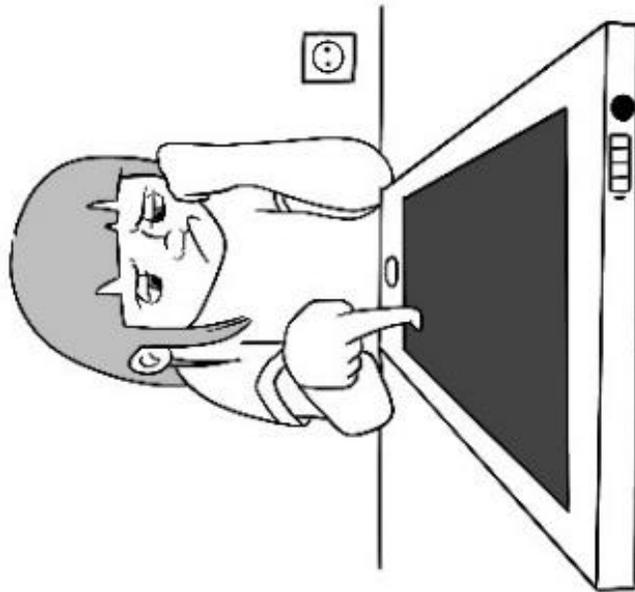
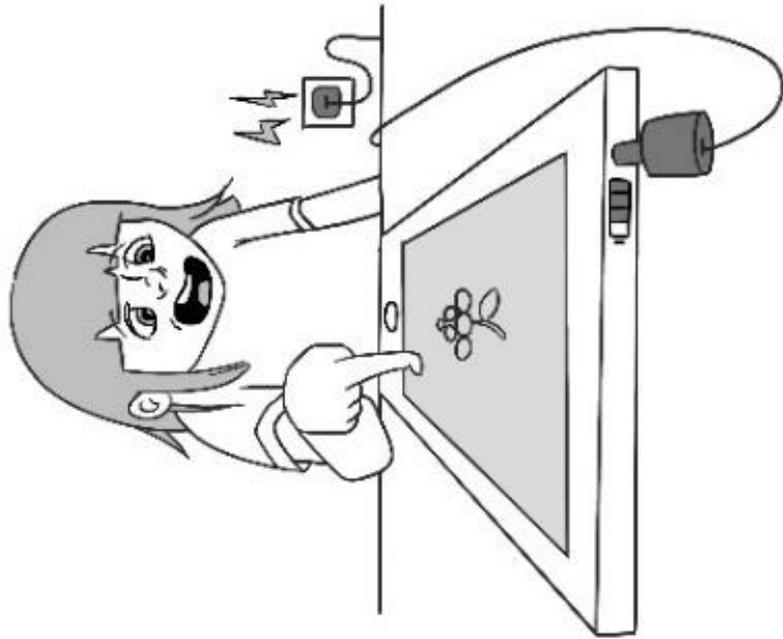
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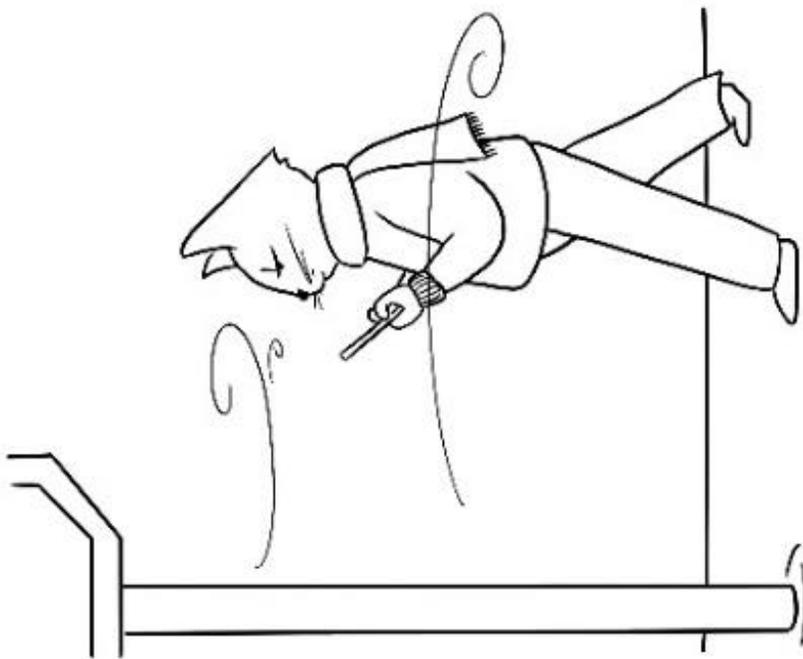
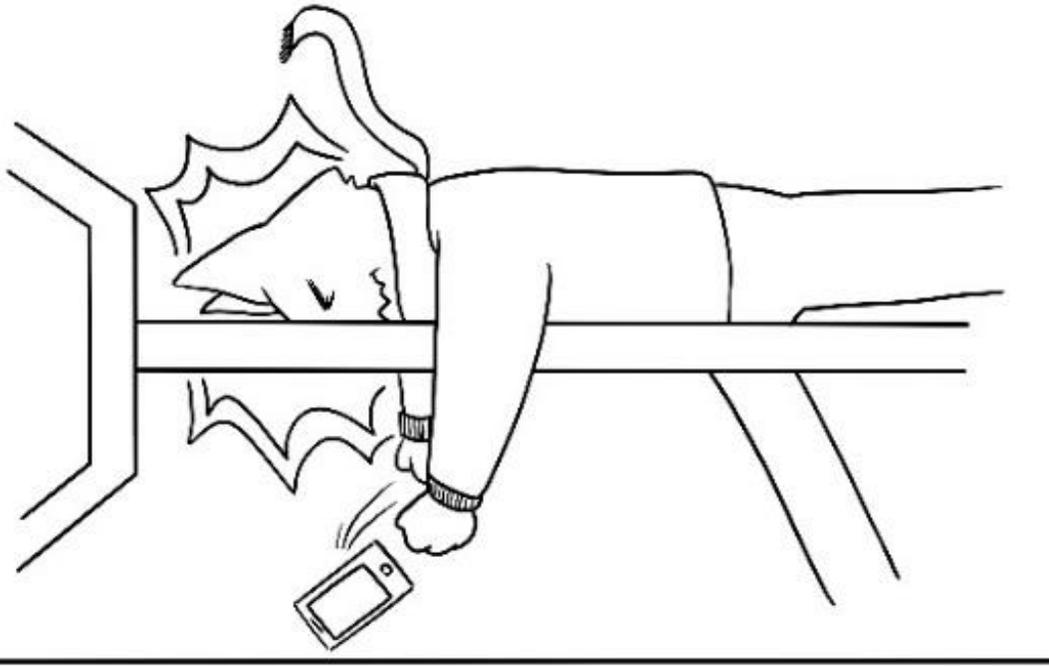
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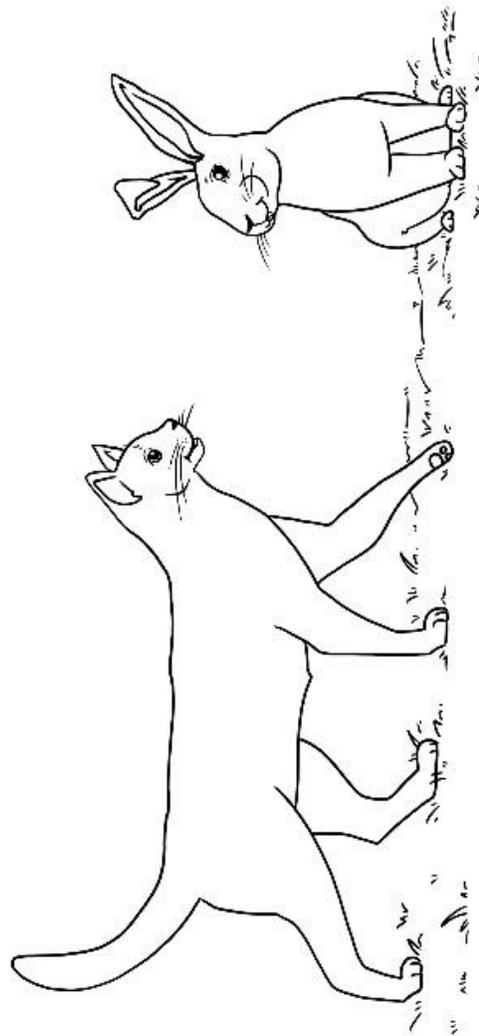
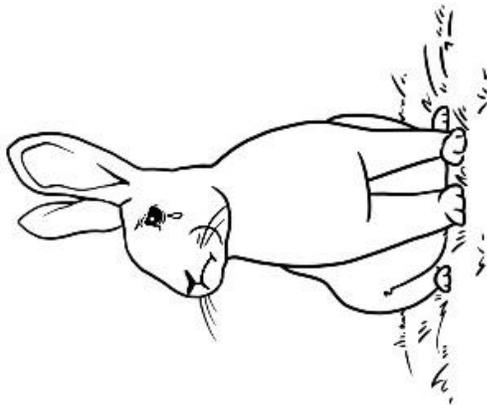
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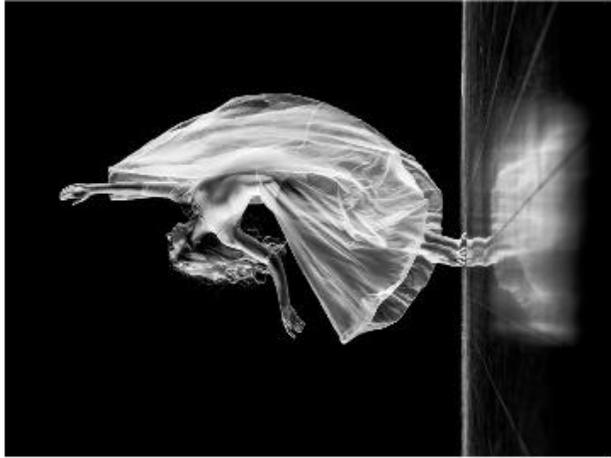
## APPENDIX B

### The Materials of The Epistemic Task

1.



2.



3.



4.



5.



6.



## APPENDIX C

### A. Annotation Guideline for The Data from Descriptive Task

0. Each description for each picture pairs are transcribed separately.

1. For each description;

1.1. It is searched whether there is a **causal relation**.

Cues (not necessarily)

- a. connective with a causal sense (için, çünkü...)
- b. possible connectives with a causal sense (implicit)
- c. some verbs that carry a causal sense<sup>1</sup>

If there isn't, annotate as 'non'.

1.2. If there is, **Arg1** and **Arg2** are specified.

Arg1: underline Arg2: double underline

Then,

1.3. Domain of relation (**content, epistemic**) is defined.

Paraphrase tests<sup>2</sup>

for content: "Situation (x) leads to the fact (y)"

"(x) durumu/ olayı (y) olgusuna yol açar."

for epistemic: "Situation (x) leads me to conclude, surmise or believe (y)"

"(x) durumu/ olayı beni (y) sonucuna; ulaşmaya, tahminde bulunmaya veya inanmaya yönlendiriyor."

When neither is appropriate, choose 'other'.

2. If the relation is provided with an **explicit connective**, select it from the list. When the connective is not in the list, you can add it into the list. Then, report it with a note below that column. If it is not, annotate as 'non'.

- If a certain connective is used twice, annotate as 1.
- If two different connectives are used, annotate them separately.

\* Do not annotate the connectives that are not used for the marked causal relation!

3. Annotate whether the child could relate two pictures (**yes**) or not (**no**).

P.S. If a relation and a connective, if any, are uttered after a question such as 'neden' or a further explanation about the task, annotate the relation and the connective in the F, G, and H columns rather than C, D, and E.

## B. Annotation Guideline for The Data from Argumentative Task

0. Each argumentation belonging each photograph set are transcribed separately.

1. For each argumentation;

1.1. It is searched whether there is a **causal relation**.

Cues (not necessarily)

- a. connective with a causal sense
- b. possible connectives with a causal sense (implicit)
- c. some verbs that carry a causal sense<sup>1</sup>

If there isn't, annotate as '**non**'.

1.2. If there is, **Arg1** and **Arg2** are specified.

Arg1: underline    Arg2: double underline

Then,

1.3. Domain of relation (**content**, **epistemic**) is defined.

Paraphrase tests<sup>2</sup>

for content: "*Situation (x) leads to the fact (y)*"

"(x) durumu/ olayı (y) olgusuna yol açar."

for epistemic: "*Situation (x) leads me to conclude, surmise or believe (y)*"

"(x) durumu/ olayı beni (y) sonucuna; ulaşmaya, tahminde bulunmaya veya inanmaya yönlendiriyor."

When neither is appropriate, choose '**other**'.

2. If the relation is provided with an **explicit connective**, select it from the list. When the connective is not in the list, you can add it into the list. Then, report it with a note below that column. If it is not, annotate as '**non**'.

- If a certain connective is used twice, annotate as 1.
- If two different connectives are used, annotate them separately.

\* Do not annotate the connectives that are not used for the marked causal relation!

**P.S.** If a relation and a connective, if any, are uttered after a question such as '*neden*' or a further explanation about the task, annotate the relation and the connective in the E- F columns rather than C- D.

<sup>1</sup>Causation covers three main kinds of causal concepts (Wolff, 2007), which are CAUSE, ENABLE, and PREVENT, and that these causal concepts are lexicalized as verbs (Wolff and Song, 2003):

(i) CAUSE-type verbs: bribe, cause, compel, convince, drive, have, impel, incite, induce, influence, inspire, lead, move, persuade, prompt, push, force, get, make, rouse, send, set, spur, start, stimulate,

(ii) ENABLE-type verbs: aid, allow, enable, help, leave, let, permit.

(iii) PREVENT-type verbs: bar, block, constrain, deter, discourage, dissuade, hamper, hinder, hold, impede, keep, prevent, protect, restrain, restrict, save, stop.

(Mirza et. al, 2014)

<sup>2</sup>Content relation gives a description of a real-world causal relation.

Epistemic relation is not a description of the real world, but it gives an argument for the one's claim.

(Derya Çokal, Deniz Zeyrek, Ted J.M. Sanders, 2020)

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