EFFECT OF TENSE, ASPECT AND ASPECTUAL CLASS ON EVENT KNOWLEDGE ACTIVATION: A STUDY WITH TURKISH ADULTS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF INFORMATICS
OF
THE MIDDLE EAST TECHNICAL UNIVERSITY

BY

ŞEVKİ YÖNTEM

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF COGNITIVE SCIENCE

MARCH 2015

Approval of the thesis:

EFFECT OF TENSE, ASPECT AND ASPECTUAL CLASS ON EVENT KNOWLEDGE ACTIVATION: A STUDY WITH TURKISH ADULTS

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ABSTRACT

EFFECT OF TENSE, ASPECT AND ASPECTUAL CLASS ON EVENT KNOWLEDGE ACTIVATION: A STUDY WITH TURKISH ADULTS

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March 2015, 72 pages

In this study we aimed to investigate effects of tense, aspect and lexical aspect on the activation of event knowledge. To this end, we conducted a short stimulus onset asynchrony (SOA) experiment, in which participants encountered a one-word sentence as a prime and reacted to a locational target word via speech. We analyzed response times with respect to aspect, tense and relatedness between prime and target words. Participants' memory spans, measured by a backward digit span task, were also included in the analyses. We found out that tense, viewpoint aspect and relatedness had no significant effect on reaction times, hence on the level of activation of latent locational arguments. However, at the level of lexical aspect, stative verbs showed more priming effect on locational nouns as

compared to non-stative verbs (activities, accomplishments and achievements).

Keywords: event activation – situation models, tense-aspect markers and aspectual (lexical classes), memory span, priming

ÖZ

OLAY ETKİNLEŞMESİNDE ZAMAN, GÖRÜNÜŞ VE GÖRÜNÜŞSEL SINIFLARIN ETKİSİ: TÜRK YETİŞKİNLERLE BİR ÇALIŞMA

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Yüksek Lisans, Bilişsel Bilimler Bölümü

Tez Yöneticisi: Dr. Ceyhan Temürcü

Mart 2015, 72 sayfa

Bu çalışmada kip, görünüş ve sözcüksel görünüşün olay bilgisi etkinleşmesine etkisini incelemeyi hedefledik. Bu amaçla katılımcıların tek kelimeden oluşan cümlelerle öncellendiği ve ses ile çevresel hedef kelimelere tepki verdiği kısa uyarıcı başlangıçlı desenkronizasyon (SOA) deneyi gerçekleştirdik. Görünüş, kip, ve öncel ve hedef kelimeler arasındaki alakalılık durumuna göre tepki sürelerini analiz ettik. Katılımcıların hafıza genişliği geriye doğru sayı dizisi testi ile ölçülerek analizlere eklenmiştir. Kip, görünüş ve alakalılıkların tepki sürelerine kayda değer bir etkisi olmadığını, dolayısıyla bilince gizli uzamsal argümanların etkinleşmesinde etkisi olmadığını tespit ettik. Fakat, sözcüksel görünüş seviyesinde, durum bildiren fiiller durum bildirmeyen

fiillere (devinimler, edinimler ve ani değişimler) göre daha fazla öncelleyici etki göstermiştir.

Anahtar Kelimeler: olay etkinleşmesi – durum modelleri, kip-görünüş ekleri ve sözcüksel görünüş sınıfları, hafıza genişliği, öncelleme

To my brother…

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to my advisor Dr. Ceyhan Temürcü for his continued interest and kind support. I am sure that this thesis would not be completed without his guidance and effort.

I thank members of METU Informatics Institute for all the enjoyable moments within the years I spent in the Institute.

I thank the members of my thesis supervisory committee, Prof. Dr. Cem Bozşahin, Prof. Dr. Deniz Zeyrek Bozşahin, Assist. Prof. Dr. Cengiz Acartürk and Dr. Duygu Özge for their constructive comments, which greatly improved the quality of this work. Especially I thank Dr. Duygu Özge for her guidance and key additions to the study, and Assist. Prof. Cengiz Acartürk for his guidance and help with the experiment design and statistical analyses.

Thanks to Yeliz Engin for her help in applying experiments and for her motivating attitude.

Last but not least, thanks to my family for their endless patience and support with my academic career and especially thanks to my wife for holding my hand every time I need.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

One of the research areas in cognitive science is situation models (also called as knowledge or mental models). It is assumed that individuals create these models in their minds to comprehend written or spoken language, by the help of linguistic features.

Natural languages include several pieces of information, conveyed by both lexical items and grammar. Tense and aspect markers are grammatical elements which contribute to these pieces of information. The present study focusses on grammatical tense and aspect markers as well as aspectual classes (lexical aspect) of verbs. Lexical aspect entails information about inherent temporal constituency of verbs.

Tense and aspect markers have different morpho-syntactic features in different languages. Most studies on these markers until now have been inferential, i.e., based on semantic or pragmatic facts about their uses. Empirical methods in this area have been relatively rare. These mainly include research on cross-linguistic category types, sometimes accompanied by questionnaires (Dahl, 1984; Bybee, 1991). There have also been some neuroimaging studies which involve cross-modal mappings (Ferretti et al., 2007; Bornkessel et al., 2005) and some psycholinguistic/behavioral studies (Ferretti et al., 2007; Carreiras et al., 1997; Madden & Zwaan, 2003; Truitt & Zwaan, 1997; Madden and Therriault, 2009; Morrow, 1990). The study aims to contribute to empirical methods in studying tense and aspect, by investigating the effects of Turkish markers including *–Iyor, -DI, -Iyor-DI, -mIş-DI* and different aspectual classes (states, achievements, accomplishments and activities) on situation models.

Ferretti et al.'s (2007) first experiment is one of the paragonal examples of experimental approaches to tense and aspect. In this experiment they showed that imperfective aspect (which focuses on internal structure of an event) primes latent locational information, while perfect aspect (which focuses on the resultant state of an event) does not. For instance the verb *cook* primes the environmental word *kitchen* when used with imperfective aspect. There are other studies which show that tense and aspect affect situation models. Characters in a narrative are more quickly available when sentences described in present tense in comparison to past tense (Carreiras et al., 1997). In another study, participants preferred pictures depicting completed events in a picture matching task after reading sentences in perfective aspect, but no such preference was there for sentences given in imperfective aspect (Madden & Zwaan, 2003). Similarly, related instruments are found to be foregrounded after imperfective sentences that describe a situation (e.g. *hammer* is primed after the sentence *He was nailing*) (Truitt & Zwaan, 1997). A similar effect was shown by Madden and Therriault (2009). Also, causal structure and durational character of events have been shown to effect processing times of semantic content. Long lasting and complex events were found to require longer processing times as compared to punctual events (achievements) because of less frequent associations (Moens & Steedman, 1998, cited in Florit & Gennari, 2011). Also these kinds of events take longer time to simulate since their representations entail more diverse multi-modal activations (Matlock, 2004; Richardson & Matlock, 2007, cited in Florit & Gennari, 2011). Sentences with causally complex (semantically causative) verbs were also shown to be processed slower than those with causally simple ones in sensicality judgment tasks (Gennari and Poeppel, 2003).

In our study on Turkish, we used a short stimulus onset asynchrony experiment, designed after Ferretti et al.'s (2007) first experiment, with some adjustments according to the properties of Turkish language. We have also used more aspectual categories and included different lexical aspectual classes. We could not replicate Ferretti et al.'s main result that imperfective aspect primes related locational words. However we have found evidence that verbs which describe states (durative verbs which involve no change) make participants react faster to target locational words. Participants were slower to react to locational nouns following a verb describing events which denote a change of state (achievements, activities and accomplishments) as compared to states. When states were compared to only achievements (punctual verbs), again, states yielded faster reaction times. This latter result may appear to be conflicting with the results of Gennari & Florit (2011), who assert that durative verbs take more processing time as compared to punctual ones (achievements). Our conclusion was that this

difference is linked to the types of response elicited in either experiments. Gennari & Florit (2011) had asked participants to provide sensicality judgments or read relatively complex expressions, both of which require relatively deep semantic processing. In contrast, the task in our experiment was to vocalize a target word, which is a relatively shallower processing. This issue will be mentioned in more detail in Section 5.2 (Discussions).

The remaining part of the thesis is as follows: Chapter 2 includes a literature review on situation models on the effects of tense-aspect markers and aspectual classes on them. Chapter 3 explains our methods, describes our pre-experiments and main experiment, and states hypotheses. Chapter 4 reports the results of the experiment. Finally, Chapter 5 presents discussions and conclusions.

CHAPTER 2

LITERATURE REVIEW

The classical view in cognitive science states that the mind is a machine that uses small structures to form greater ones, especially in processing language (Chomsky, 1957; Fodor, 1983; Pylyshyn, 1986). In semantic processing, perceived pieces of linguistic information (morphemes and sentences) are converted into mental constructs (i.e. propositions) which are then used in a variety of ways. But there exists no consensus about how this construction (i.e. converting perceptual inputs into abstract propositional representations) takes place (Barsalou, 1999). It appears that situation models, as mental representations of the immediate linguistic context, play a role even at lower-level processes of lexical comprehension.

Consider the following sentences from Zwaan (2005):

(1) The exterminator checked the room for bugs.
(2) The CIA agents checked the room for bugs.

It is clear that in these sentences the meanings of the words "bugs" are not the same. This challenge of ambiguity can be handled, without necessary recourse to situation models, by consulting to associations among co-occurring words in the sentence. Here is a similar challenge:

(3) Fred stole all the books in the library.
(4) Fred read all the books in the library.

Here, the meaning of the word "book" changes according to context. In (3) there could be 12 copies of the same book but in (4) the person could only have read one copy of the book. Such differences in interpretation are best explained by

models of lexical competence which confer a role to contextual effects on processing. Pustejovsky's (1995) mechanism of co-composition, for instance, deals with such cases by adopting richer lexical representations and rules of semantic composition, again without necessarily invoking situation models. Here is another example, which presents a pair of sentences in which imagery is obviously different:

(5) He saw the eagle in the sky.
(6) He saw the eagle in the nest.

In these two sentences the imagery invoked by the word "eagle" are different (Zwaan, Stanfield, & Yaxley, 2002, cited in Zwaan, 2005). In (5) the eagle's wings are stretched out whereas in (6) the wings should be drawn in. Such differences in meaning, which seem to involve vagueness, is best explained by invoking situation models, as mental representation of the situation described in the utterance.

Situation models have been studied from a variety of different perspectives. Among different pieces of information included in sentences, tense and aspect markers have been shown to have an effect on how situations are conceived. In a study by Morrow (1990) participants were asked to locate a figure (e.g., "John") after reading sentences like (7) and (8) on a house plan at the time described by the sentences:

(7) John was walking from the kitchen to the bedroom.
(8) John walked from the kitchen to the bedroom.

Morrow (1990) found that sentences with imperfective aspect, as in (7), lead participants to locate the figure between the corresponding rooms. In contrast, participants located the figure at the goal when sentences were given in perfective aspect ("bedroom" for the examples above).

In cognitive science, research of the role of temporal markers emerged in 1980s, in studies on mental models (Johnson-Laird, 1983) and on situation models (Van Dijk & Kintsch, 1983). The idea behind these studies was that mental models (or, situation models) are not created for only processing linguistic input, but as mental representations of the described situation (Zwaan, 2008). The next section provides some background information on situation models.

2.1 Situation models

Situation models are mental representations humans are assumed to construct while processing linguistic inputs, and make use for their reasoning processes. They are conceived somewhat differently in different theoretical frameworks on language comprehension.

One of the theories is the construction-integration model (Kintsch, 1988). It is a collection of works from 1978 and updated in 1998 with contributions from Teun Adrianus Van Dijk and Jim Miller. The theory comprises steps from recognizing words to constructing a situation model as a representation of the meaning of a text. The emphasis of the theory is on establishing the meaning. This model states that people create three mental representations to comprehend a text. These are verbatim (propositional) representations of the text, a semantic representation, and a situational representation. These sub-models are used in a cycle in which new propositions are processed.

Most situation model theories focus on relations among event representations. They try to answer what happens when new information is encountered in relation to old information. This is a macro-level approach to situation models. One such theory is event-indexing theory proposed by Zwaan, Langston, & Greasser (1995). They propose that situation (event) models are mainly divided into five dimensions, which are time, space, entity, causation, and intentionality. These dimensions are used to connect new propositional information to old information. They state that if propositions have overlap among these dimensions, it is easier to transfer information from short-term memory to long-term memory and the connections in long-term memory are stronger (Zwaan, 1996). They also claim that there must be more dimensions with related to situation models.

The present study aims to research what is going on at the micro level in relation to time and space. It searches effects of grammatical aspects and aspectual classes in Turkish in modulating information about locations.

2.2 Tense, aspect and aspectual class

2.2.1 Tense

Tenses are grammatical markers which define the primary temporal relation between the reference time expressed in a sentence and the speech time. Most languages feature a binary tense system, which consists of past and present. These two tenses are exemplified by the following pairs of English sentences:

(9) John loves Mary (present)
(9') John loved Mary (past)

(10) John is eating (present)
(10') John was eating (past)

(11) John has eaten (present)
(11') John had eaten (past)

2.2.2 Aspect

It should be clear from English examples given above that tense is not sufficient, on its own, to characterize temporal relations involved in sentences. While tense describes the distance of an event (or a series of events in a narrative) from the speech time, aspect sets cues as to how the event is construed as to its internal temporal constituency (Comrie, 1976; Langacker, 1982; Smith, 1991, cited in Ferretti et al., 2007).

Imperfective aspects (which mainly include progressive/continuous and habitual aspects) impose an internal viewpoint on an event or a series of events. Progressive or continuous aspects do this by presenting an event or state as ongoing at the reference time.

Similarly, habitual aspect marks a temporally extended event/state or a series of repeated events. The sentences (10) and (10') above are examples of progressive aspect (marked by the periphrastic strategy *be … ing* in English). Progressive strategies which can also appear with stative verbs are called "continuous aspect" cross-linguistically. English lacks a continuous aspect, since *be … -ing* can normally be used only with non-stative predicates. English also lacks a dedicated

strategy for habitual aspect, although the unmarked verbal form, especially when used with events, yields a habitual interpretation:

(11) John walks to school everyday

In contrast to progressive and continuous aspects, both the perfect and the perfective aspects present an event as a whole and as finished. What differentiates the perfect from the perfective is that the former also implies some lingering effects of the event at the reference time. Below (12) illustrates the past perfective strategy in English, and (13), present perfect:

(12) John ate at five
(13) John has eaten

Most empirical studies on the effects of tense and aspect on situation models in English have used *was –ing* as an imperfective aspect, *had –ed* as a perfective aspect.

2.2.3 Aspectual class

Aspectual class (or lexical aspect, Aktionsart, eventuality type) describes the inherent temporal constituency of an event/state expressed by a verb. Categorizations are mostly based on Vendler's (1957) taxonomy, which includes (1) states, (2) accomplishments, (3) achievements and (4) activities. Here are examples of English verbs with their lexical aspects (Van Valin, 2008: pp 28):

States: be sick, *be tall, love, know, believe, and have*
Achievements: *explode, collapse, shatter* (the intransitive versions)
Accomplishments: *melt, freeze, dry* (the intransitive versions); *learn*
Activities: *march, walk* (the intransitive versions); *swim, think, snow, write*

2.2.4 Effects of aspectual class on situation models

According to Moens and Steedman (1988) an event is composed of three main parts: an initial state, the actual event and an end (resultant) state. Different semantic objects (e.g. entities, objects, items) may be associated with each of these conditions. These objects are causally and temporally related to each other. See Figure 1 for an illustration.

Different semantic elements about an event can be salient or not according how it appears in a text or speech. For instance, instruments and locations are primed by imperfective aspect (Truitt & Zwaan, 1997, Ferretti et al., 2007). This is linked to the fact that imperfective aspect focuses on the internal structure of an event, whereas perfective aspect focuses on the final state.

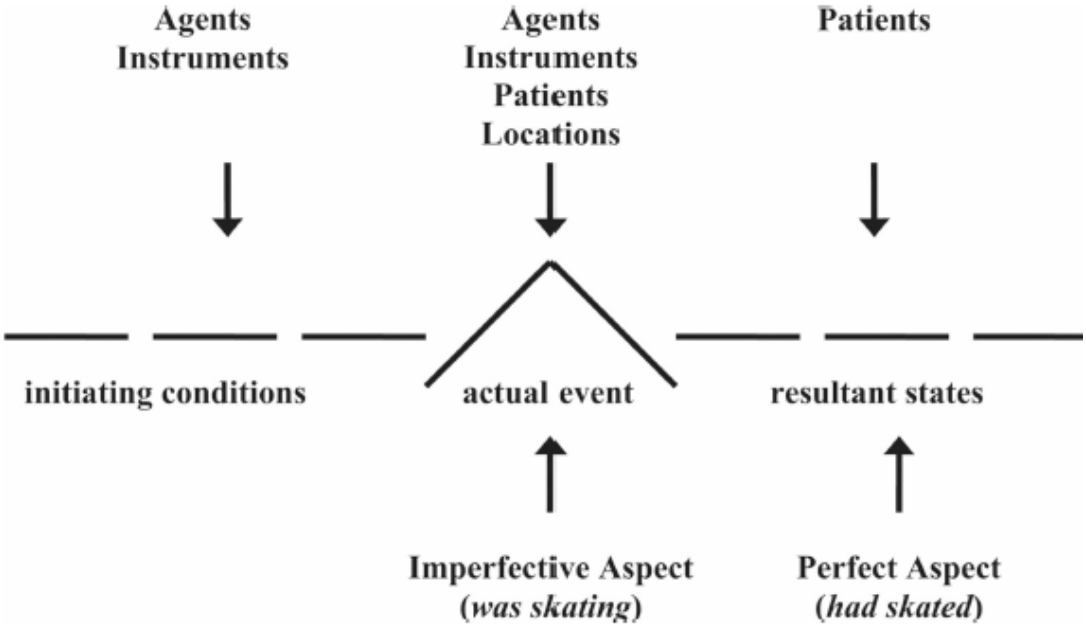

Figure 1 Verb aspect, thematic roles, and their general relationship with temporal and causal structure of events (Ferretti et al., 2007)

2.3 Aspectual classes in Turkish

Koç (1996) divides lexical aspect in Turkish into four main classes: (1) start-up indicative verbs *(belirmek, başlamak, açmak, tutuşmak, kalkmak, ihtiyarlamak)*, (2) prolongation indicative verbs *(aramak, beklemek, yaşamak, çalışmak, uyumak, gezmek, koşmak, yürümek, yüzmek)*, (3) completion indicative verbs *(pişmek, içmek, yemek,*

bulmak, yıkmak, uyanmak, ölmek, yetişmek, ulaşmak), and (4) non-temporal verbs *(bilmek, anlamak, düşünmek, tiksinmek, sevmek, tatmak, görmek, sevinmek, anlaşmak)*.

In another study (Bacanlı, 2008), based on Uğurlu (2003, cited in Bacanlı, 2008) and Johanson (1996: 236-237; 1999b: 173-174; 2000b: 62-63, cited in Bacanlı, 2008), aspectual classes are gathered under two headings: homogeneous and heterogeneous verbs. Homogeneous verbs are atelic; they do not have specific start and end points ontologically. This category is divided into stable (*sevmek, hoşlanmak, düşünmek*) and dynamic (*yürümek, koşmak, gitmek, çalışmak, okumak*) verbs. Heterogeneous verbs (*doğmak, ölmek, girmek, çıkmak, gelmek, varmak, düşmek, bitirmek*) directly state an end point. There is another class in which the verb starts with a change and proceeds with an atelic occurrence (e.g. *giymek, uyumak, yatmak, oturmak, saklanmak, korkmak, tutmak, olmak*). This class is called initio-transformative by Johanson (2000b:62-63, cited in Bacanlı, 2008) and stated as occurring in most Turkic languages. Bacanlı concludes that lexical aspects in Turkish are mainly divided into end-limited, end-unlimited and initio-transformative. Also, there are verbs (*erimek, donmak, artmak, azalmak, kurumak, büyümek*) in Turkish that could be used both as telic and atelic (Aksan, 2003). These verbs specified as degree achievements.

One of the most extensive tests for classifying verbs as to their aspectual classes is presented in Van Valin's (2008) work. There are seven test steps stated in this work. Some of the tests are admittedly language-specific, and some of them are not applicable to Turkish. For instance, in English stative verbs cannot be marked with the progressive aspect (*be... –ing),* while the Turkish progressive strategy, *-Iyor* can be used with states. Hence a systemic classification was needed to classify our experimental stimuli.

Temürcü (2007) delimits aspectual classes with step by step categorization. Events are categorized with respect to the binary parameters of punctuality, change of state, telicity, and energy requirement. Figure 2 below illustrates these steps in this classification. We used this approach to classify Turkish words to be used in the experiment. Semelfactive category was omitted in order to abide by Vendler's categorization.

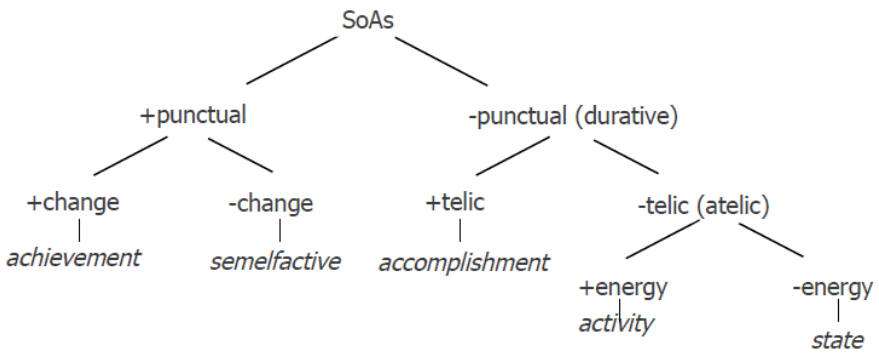

Figure 2 Classification of states-of-affairs according to their aspectual types (from Temürcü 2007: p 21)

2.4 Experimental studies on effects of tense and aspect on situation models

Various scientists researched the role of verb aspect in construction of situation models. The null hypothesis in these studies is that verbal tense and aspect are tools for manipulating information related to events and activating world knowledge about properties of events (Ferretti et al., 2007).

Most such studies rely on the basic assumption that words are related to each other by associational links and/or frequency of co-occurrence in discourse, and their processing activates related words/concepts (e.g., Simpson, 1984, Schwanenflugel, 1991)

Several studies demonstrated that verbs are important source of information about situations (events). Instruments, participants, time course, duration and location information are quickly available for processing of sentences (Altman & Kamide, 1999; Ferretti, McRae, & Hatherell, 2001; McRae, Ferretti, & Amyote, 1997; McRae, Spivey-Knowlton, & Tanenhaus, 1998, Ferretti et al., 2007, cited in Ferretti et al., 2007). This kind of conceptual information is under the effect of inflectional morphology of verbs and participles which signal voice, tense and aspect (Madden & Zwaan, 2003; Magliano & Schleich, 2000) and also lexical aspectual classes of verbs (Florit & Gennari, 2011).

Carreiras et al. (1997) showed that participants access characters in narratives more quickly when the text is presented in present tense as compared to past tense. Job descriptions were given with relation to a main character. Participants reacted faster to stimuli related to the character after reading the narrative in present tense. They concluded that associations between dimensions of situation models are effected by verb tense.

In another study (Madden & Zwaan, 2003), participants chose (and reacted faster to) pictures that describe a completed rather and an uncompleted event after reading a perfective sentence, but no such effect was observed with imperfective sentences. In a different experiment they read perfective sentences faster than imperfective ones after being presented with pictures of completed events.

Also instruments (e.g. hammer) are activated more in mental models after imperfective than perfective sentences depicting a situation related to the usage of the instrument (Truitt & Zwaan, 1997). Another foregrounded activation is about location. People were asked to judge the location of a character after reading a sentence about their movements. Participants judged the location as on the way to a destination after imperfective sentences and as reached to their destinations after perfective sentences (Morrow, 1990).

Another inspirational study, by Madden and Therriault (2009), is about the priming of tools with perfective and imperfective aspects. They prepared sentences which described the objects in use (e.g. *Fred was using his umbrella*) and as used (e.g. *Fred had used his umbrella*), and showed participants sentences in which the noun was replaced by a picture of the object the noun refers. Two kinds of pictures were prepared: one depicting the object as in use, and the other as used. These phrases were followed by a prepositional phrase (e.g. *in his library*). The procedure involved measuring word-by-word reading as well as sensibility (meaningfulness) judgments. They found that images of objects in use are processed faster regardless of grammatical aspect. They also found that participants read the prepositional phrase faster, which followed pictures of objects, when sentences were given in imperfective aspect. For sensibility judgments too, the effect of pictures of in use was found to be significant with sentences marked with imperfective aspect.

Ferretti et al.'s (2007) first experiment, on which the experimental design of the current thesis is based, also discovered effects of verb aspect on situation models. Their design was a short stimulus onset asynchrony experiment. Participants

were presented with a fixation point (+) for 250 milliseconds, then a prime verb phrase (e.g. *was skating*) for 250 milliseconds, and finally a target locational word (e.g. *arena*) until the participants named (pronounced aloud) it. Participants vocalized the target words as fast as they could and response times were recorded via PsyScope software. There were 24 action verbs, in past perfect (*had –ed*) and past imperfective (*was –ing*) categories, and related and unrelated locational words as targets. They found significant interaction between aspect and relatedness. Locational words related to presented verbs were primed with imperfective but not with perfect verb phrases. Imperfective aspect primed related locational nouns with a mean difference of 21 milliseconds. But surprisingly, they could not show a general effect of relatedness on response times.

In a collection of studies, Florit and Gennari (2011) showed that participants spent more time on processing durative events than non-durative events, in an online language processing task which involved a sensicality judgment. They explain this result by stating that durative events occur in more diverse situations and have more semantic and contextual associations, which results in increased processing times for judging sensicality.

2.5 Semantic vs. associative priming

There exists a consensus that subjects react faster to word pairs when they are related. This agreement starts with the findings of Meyer and Schvaneveldt (1971), who showed that participants react faster to related word pairs (e.g., CAT-DOG) in a lexical decision task, as compared to unrelated word pairs (e.g., CAT-PEN) (cited in Balota et al., 2006, p. 327)

In *semantic priming* the prime and the target are from the same paradigmatic category, share semantic features, display perceptual similarity or metonymic relation. For example, the word *house* is a semantic prime for *building*, because the former is a hyponym of the latter. Or, the words *dog* and *wolf* would prime each other, because they are taxonomic sisters and share some features.

In *associative priming*, the target and the prime words are hypothesized to be cognitively related because of the high probability of appearing together in speech or text. The prime and the target may or may not share semantic features. *Dog* will be an associative prime for *cat*, not because of the semantic similarity of these two words, but because they frequently appear together in speech or text

(e.g. as in *raining cats and dogs*). Associative priming also includes *context priming*, where the discursive or syntactic context facilitates, hence speeds up processing for words/morphemes which are likely to occur in the context.

The debate about nature of priming in different language comprehension/production tasks (i.e., whether it is associative or semantic) still continues. We will discuss this issue in relation to our results in the Discussions section.

2.6 Spreading activation account

Spreading activation or *semantic network* account is proposed to be the main mechanism behind semantic priming. When a subject encounters a word, the activation of that word's semantic content also activates related lexical items or nodes in the mind/brain. There are various developments in cognitive psychology which rely on the spreading activation paradigm (Anderson, 1976, 1983; Collins & Loftus, 1975; Posner & Snyder, 1975, cited in Bolata et al., 2006, p. 333). Some semantic network studies based on nouns (e.g., Collins & Quillian, 1969) and verbs (e.g., Gentner, 1975; Rumelhart & Levin, 1975) are also influenced by this paradigm (cited in Ferretti et al., 2007).

Priming observed with verb-latent participant pairs in situation models generally attribute priming effects to spreading activation (see Neely, 1991, for an extensive review, cited in Ferretti et al., 2007). These kinds of associations based on relatedness are established by word-association norms (EX; Ferretti's previous study, 2001). As to the effects of the imperfective vs. perfective aspects, one could suggest that verbs with imperfective aspect establish associations with co-occurring locations in situation models (a metonymic relation), and priming effects of imperfective aspect would be explained by spreading activation (Ferretti et al, 2007). However, Ferretti group showed that there is no main effect of relatedness to response times of participants. There exists significant evidence for imperfective aspect that it primes locational nouns under related conditions but no significant main effect were found for the effect of relatedness. They showed that the related pairs have lesser average mean reaction time than unrelated pairs (21 milliseconds) under the effect of imperfective aspect. This means that associations established by relatedness may not always result in priming effects. Hence they concluded that spreading activation account cannot handle the priming effect of grammatical morphemes on its own.

2.7 Embodied spreading activation

There is evidence for temporal properties of serial processes (i.e. phonological, lexical and grammatical) of language production at circuit level in the brain. Sahin et al. (2009) used intracranial electrophysiological measurements to show that lexical processes happen in the brain in around 200 milliseconds, grammatical processes in around 320 milliseconds, and phonological processes in around 450 milliseconds in Broca's area, while people read words verbatim or grammatically inflected them. This information sheds light to the common idea that if there is spreading activation, it happens within the lexical processes. In other words, spreading activation starts to happen between 100 and 200 milliseconds. Intracranial readings of Sahin et al. show that the lexical processes start to occur after 100 milliseconds and peaks at the 150-200 milliseconds interval. Before this time period, visual word form area and temporal lobes are activated for primary lexical access in a word recognition or pronunciation task. One should note that, temporal lobes are especially associated with Broca's area (Sahin et al., 2007; Friederici, 2009, cited in Sahin et al., 2009). This brings out the hypothesis that the priming effects in a SOA could be replicated with 150 millisecond prime duration.

2.8 Threshold

There is evidence that priming still occurs under decreased thresholds where participants are not sure about presence of a prime (Balota, 1983; Carr & Dagenbach, 1990; Dagenbach, Carr, & Wilhelmsen, 1989; Fowler, Wolford, Slade, & Tassinary, 1981; Marcel, 1983; Marcel & Patterson, 1978). Similar findings exist for pronunciation tasks (Carr et al., 1982; Hines et al., 1986) (cited in Balota et al., 2006, p. 329).

CHAPTER 3

EXPERIMENTAL DESIGN, METHODS AND HYPOTHESES

3.1 Overview of experiments

The present study aims to search the effects of grammatical aspect and lexical aspect on situation models, specifically, on the priming of latent locational arguments of verbs. The experimental results will let us see if there exists a significant priming effect within related and unrelated pairs and second, check the significance of the priming effect within temporal and aspectual categories. This chapter explains the methods and hypotheses of the experiments conducted for this study. Results will be presented in Chapter 4.

This study basically follows the design of Ferretti et al.'s (2007) first experiment, which uses a short stimulus onset asynchrony (SOA) experiment. SOA is a design where the time between prime and target words is very short. The procedure in Ferretti et al. (2007) was as follows: First, a fixation point (+) was screened on a computer monitor for 250 milliseconds, then a prime word was screened for participants to read inside (e.g. *had cooked*) for 250 milliseconds, and lastly, a target word (e.g., *kitchen*) was screened for 1000 milliseconds, to be responded by reading aloud. 24 verb-location pairs were presented to each participant: 6 related past imperfective pairs, 6 unrelated past imperfective pairs, 6 related past perfect pairs, and 6 unrelated past perfect pairs. Reactions times of speech responses were recorded.

Our experiment differs from that of Ferretti et al. (2007) in the following four ways: (1) the experiment is applied to Turkish data, whose tense-aspect system is both morpho-syntactically and semantically different from that of English. (2) more tense-aspect inflections were used (present continuous, present habitual

and past perfective in addition to past continuous and past perfect). (3) verbs from different aspectual classes were represented, and (4) there were pre-experiments with 150, 250, 600 prime durations and finally a main experiment with 900 milliseconds.

(1)

In Ferretti et al's (2007) study *was ... ing* was used for marking imperfective aspect and *had ...–ed* for marking perfect aspect. Closest Turkish correspondences of these markers are *–Iyor-DI* and *–mIş-DI* respectively. Although Ferretti et al. (2007) use the *have ... -ed* strategy for marking the perfect aspect, it can actually also express a 'past in the past'. Thus, semantically speaking *had ... -ed* does not necessarily express perfect meaning.

Turkish does not have a dedicated perfect aspect marker; simple (perfective) past and perfect aspect are expressed similarly: by *-DI* when relative to present reference time, and by *-mIş-DI* when relative to past reference time.

There are also some important differences as to how imperfective aspects are coded in the two languages. The closest counterpart of English progressive aspect is *–Iyor* in Turkish, although it is best described as *continuous* marker rather than a progressive marker, since it can also be used with stative verbs (e.g., bil-*iyor*-um 'I know', anl-*ıyor* 'he/she understands').

Also related to this difference, habitual aspect, which is the unmarked strategy in English, is marked by a distinct morpheme for both dynamic events and states and in Turkish: the so-called Aorist marker *-Ir*. Examples: koş-*ar* 'runs' and bil-*ir* 'knows'.

(2)

In addition to past perfect/past in the past (*-mIş-DI*) and past continuous (*-Iyor-DI*), present continuous *–Iyor*, present perfect/past perfective *–DI*, and present habitual (*-Ir*) were included in the date set of the experiment, in order to check any potential effects of different combinations of grammatical aspect and tense on priming of latent locational arguments.

(3)

Verbs from different lexical aspect classes were included in the data set. Verbs were selected under the categories stative, accomplishment, activity and achievement. This is because we wanted to see any potential effects of aspectual class on the priming of locational information, and also to be able to compare our results to those of Florit & Gennari (2011), who showed that participants need more processing time for durative events as compared to non-durative events in online language processing tasks.

(4)

Since we had not found any similar studies for Turkish, we had to conduct a series of preliminary experiments to come up with an optimal prime duration. After pre-experiments with 150, 250 and 600 milliseconds, we decided to use 900 milliseconds for our main experiment.

Most of the priming studies in the literature focus on single word studies since it is easier to control variables. In the present study we also used one-word sentences as stimuli. The pro-drop feature of Turkish allowed us to establish one-word sentences, which were created by taking a verb as root and adding tense-aspect and person designation morphemes.

Before presenting the details of the main experiment (with 900 milliseconds priming duration), we will report our methods and hypotheses regarding our preceding experiments.

3.2 Pre-experiments with 150 and 250 millisecond prime durations

We first conducted some pilot studies for determining the main factors that influence participants' responses in SOA lexical decision tasks.

First, we tried to match our stimuli to those used in Ferretti et al. (2007). We formed a list of 10 action verbs in Turkish. The list included verbs with one and two morphemes. Indeed, there is a consensus that word length and frequencies are the main factors that affect lexical decision tasks (Balota et al., 2006, p. 312). This is because these factors affect the duration the participants reading a word silently. This led us to select verbs with short length. Another measure for minimizing morpho-syntactic processing efforts of participants includes the use

of third person agreement in prime sentences. Turkish uses a null strategy to designate third person singular. This way, priming stimuli were minimized in length by choosing 2-5 letters long words. This decision were in line with our particular aim to decrease the SOA priming duration

Tense-aspect inflections we used in the first two pre-experiments were present progressive (*–Iyor*), past progressive (*-Iyor-DI*), simple past (perfective) (*-DI*), present habitual (*-Ir*), and past habitual (*-Ir-DI*). We applied the experimental design with 150 and 250 milliseconds prime durations. 250 milliseconds was the prime duration that Ferretti et al. (2007) had used.

We also applied 150 milliseconds to see if the results of Ferretti et al. (2007) could be replicated. Sahin et al. (2009) showed with intracranial electrophysiology (ICE) (i.e. recording local field potentials from populations of neurons using electrodes implanted in language-related areas of the brain) that lexical processes happen in around 200 milliseconds, grammatical processes in around 320 milliseconds and phonological processes in around 450 milliseconds in Broca's area. They also state that lexical processes start to occur after 100 milliseconds and peak at 150-250 milliseconds. In accordance with these findings, we hypothesized that if relatedness affects the reaction times of participants in a vocalization task (Ferretti et al., 2007), this might be replicated with a design that has 150 milliseconds prime duration instead of 250 milliseconds.

The stimuli of the experiments consisted of 10 verb-noun pairs (see Table 1 below) which would be rotated across two relatedness category (related and unrelated) and five tense markers which express either of two aspects (perfective and imperfective).

Table 1 Verbs and nouns used in the experiment, 150 and 250 ms conditions

	Action verb	Related Location	Unrelated action verb
1	Piş/be cooked	Mutfak/kitchen	Fırlat/throw
2	Avla/hunt	Orman/forest	Tut/hold
3	Otur/sit	Park/park	Soyun/undress
4	Uç/fly	Gökyüzü/sky	Yıka/wash
5	iç/drink	Bar/bar	Kes/cut
6	Yürü/walk	Yol/way	Sil/erase
7	Göm/bury	Mezarlık/graveyard	Vur/hit
8	Ye/eat	Restoran/restaurant	Gez/travel
9	Giy/wear	Oda/room	Kaç/escape
10	Alkışla/applaud	Tiyatro/theatre	Oku/read

3.2.1 Methods

The stimuli consisted of priming words and target words. Priming words were verbs to which tense-aspect markers (e.g. *–Iyor*, *-DI*) were added. Target words were nouns that name locations (e.g. *mutfak* 'kitchen', *yol* 'road').

Participants: Both experiments (with 150 and 250 milliseconds prime duration) were applied to 20 participants. All participants were native Turkish speakers among Middle East Technical University students. Participants were equally distributed among males and females.

Materials: Two lists were created using 10 verb-noun pairs. Each list had 5 sub-lists in which an offset strategy was applied to increase the variation of tense-aspect markers among participants. The offset strategy was applied according to subject number by using E-prime software's nested list property. For instance, participants 1 and 6 saw the same list since we rotated 5 sub-lists twice for ten participants. Participants 11 and 16 saw the second list's sub-lists (see Table 2 below).

Table 2 Variations used for List 1

	Variation 1 for subjects 1 and 6	Variation 2 for subjects 2 and 7	Variation 3 for subjects 3 and 8	Variation 4 for subjects 4 and 9	Variation 5 for subjects 5 and 10
1	Pişiyor-mutfak	Pişiyordu-mutfak	Pişti-mutfak	Pişer-mutfak	Pişerdi-mutfak
2	Avlanıyordu-orman	Avlandı-orman	Avlanır-orman	Avlanırdı-orman	Avlanıyor-orman
3	Oturdu-park	Oturur-park	Otururdu-park	Oturuyor-park	Oturuyordu-park
4	Uçar-gökyüzü	Uçardı-gökyüzü	Uçuyor-gökyüzü	Uçuyordu-gökyüzü	Uçtu-gökyüzü
5	içerdi-bar	içiyor-bar	içiyordu-bar	içti-bar	içer-bar
6	Siliyor-yol	Siliyordu-yol	Sildi-yol	Siler-yol	Silerdi-yol
7	Vuruyordu-mezarlık	Vurdu-mezarlık	Vurur-mezarlık	Vururdu-mezarlık	Vuruyor-mezarlık
8	Gezdi-tarla	Gezer-tarla	Gezerdi-tarla	Geziyor-tarla	Geziyordu-tarla
9	Kaçar-oda	Kaçardı-oda	Kaçıyor-oda	Kaçıyordu-oda	Kaçtı-oda
10	Okurdu-tiyatro	Okuyor-tiyatro	Okuyordu-tiyatro	Okudu-tiyatro	Okur-tiyatro

The two lists differed from each other with reference to target words' relatedness. The first list contained related target locational nouns for the first 5 items, and

unrelated locational nouns for the last 5 items. In the second list, unrelated nouns were matched with the first 5 items, and related nouns were matched for the last 5 items. Target words did not vary between the lists so each target noun served as its own control.

As such, participants encountered each tense marker once per relatedness type. In other words each tense marker was used twice in a list; one in related condition and one in unrelated condition.

Filler trials were also used, which included 10 unrelated verb-noun pairs. The same filler list was used for all participants (see Table 3 below). Filler trials consisted of every tense marker twice.

Table 3 Filler Trial Items for 150 and 250 milliseconds conditions

#	Verb	Noun
1	Anla/understand	Cami/mosquito
2	Bak/look	Hamam/hammam
3	ilgilen/care	Okul/school
4	iste/want	Sirk/circus
5	Büyü/grow	Köy/village
6	Önemse/mind	Sinema/cinema
7	Paslan/rust	Gar/station
8	Sat/sell	Lokanta/restaurant
9	Vurgula/emphasize	Köprü/bridge
10	inan/believe	Stüdyo/studio

Also a practice trial was prepared with twenty items in which all tense markers occurred four times.

Procedure: Stimuli were presented on a 15.4 inch Lenovo G530 notebook using E-Prime software (version 2.0.8.90). The priming paradigm used was short stimulus onset asynchrony (SOA). Each trial was composed of a fixation point (+) for 250

milliseconds, priming sentence (e.g. *koşuyor*) for 150 milliseconds for one group and 250 milliseconds for the other group, and a target locational noun (e.g. *orman*) for 1000 milliseconds. Experiments lasted around 5 minutes for a participant.

The instructions were: (1) read inside the word that appears after the fixation point (in 150/250 milliseconds threshold), (2) read aloud the second word to the microphone as soon as possible.

Vocalization response times were recorded via a microphone connected to serial response box of E-Prime software. Vocal responses were not recorded. All participants were attended to a practice session before the experiment.

3.2.2 Hypotheses

The primary aim of these two experiments was to check for priming effects for the continuous aspect marker *–Iyor* with respect to the perfective aspect marker *–DI*. Continuous marker *–Iyor* was hypothesized to have more prominent priming effect for locational words than perfective marker *–DI,* since there are findings in literature where imperfective aspect has priming effect for agents, tools and locational words as compared with perfect or perfective aspect (see Literature Review section). Hence our first hypothesis was:

H1: *The mean reaction time with items marked with –Iyor (present continuous) will be shorter than that with items marked with –DI (perfect/past perfective).*

–Iyor-DI is also an imperfective strategy, which expresses ongoingness at a reference time shifted to past. Hence, our second hypothesis was:

H2: *The mean reaction time with items marked with –Iyor-DI (past continuous) will be shorter than that with items marked with –DI (perfect/past perfective). .*

We also wanted to compare other markers of imperfectivity in Turkish (habitual forms *-Ir* and *–Ir-DI*) with the perfect/perfective marker *–DI*.

H3: *The mean reaction time with items marked with -Ir (present habitual) and –Ir-DI (past habitual) will be shorter than that with items marked with –DI perfect/past perfective.*

Another issue we wanted to track was how tense (the difference between present and past) would affect the priming of latent locational information. To the best of our knowledge, there are no comparisons of present and past progressive forms in the literature. Our idea was that present time reference would evoke more accessible situation models than past time reference, due to the effect of proximity to the communicative situation. Hence, present forms would create faster reaction times than past forms. So, our hypothesis was:

H4: *The mean reaction time with items marked with –Iyor (present continuous) will be shorter than that with items marked with –Iyor-DI (past continuous). Similarly, –Ir (present habitual) would yield faster reaction times as compared to –Ir-DI (past habitual).*

We also wanted to investigate a possible effect of different types of imperfective aspect: progressive/continuous vs. habitual. This comparison also lacks the attention of the literature. We suspect that priming effect is specifically related to progressive marker (*-Iyor*), due to the effect of specificity. This is because continuous/progressive aspects, in their prototypical use, focus to a specific event or state which is unfolding at the reference time, while habitual forms refer to an indefinitely plural or generic events/states. We hypothesize that specific/definite reference to events would create more salient, hence more easily accessible situation models than indefinite/generic reference. Thus our next hypothesis was:

H5: *The mean reaction time with items in continuous forms (–Iyor and -Iyor-DI, respectively) will be shorter than that with items in habitual form (-Ir and -Ir-DI, respectively).*

Also we wanted to inspect the effect of relatedness. According to literature, participants are faster in reacting to related items as compared to unrelated items under the priming effect of imperfective aspect (Ferretti et al., 2007). Accordingly, our hypothesis was:

H6: *The mean reaction time with related item pairs will be shorter than that of unrelated pairs for imperfective aspects (-Iyor, -Iyor-Dı, -Ir, -Ir-DI) as compared to the perfective aspect (-DI).*

Finally we wanted to control the effect of prime duration to our design and also to SOA pronunciation tasks. If we can find priming effect with a 150 milliseconds prime duration within the SOA experiment design, this could be an evidence for a spreading activation of information within lexical-morphological processes,

before the activation of word level meaning (For evidence behind this assumption, see section 2.7 and 2.8**.)** In other words, morphological processes involved in the concatenation of tense and aspect markers would involve semantic activation, similar to word level processes. Hence, our last hypothesis was:

H7: *Similar priming effects will be observed when the experiment design is applied with 150 and 250 milliseconds priming durations.*

3.3 Auxiliary studies to determine optimal reading durations

After obtaining the results of pre-experiments (see Chapter 4, Results), we concluded that priming duration of 150 and 250 milliseconds should be revised. We conducted a brief probe to determine necessary durations for inside reading corresponding to prime duration in our SOA design. 10 people were participated in this study. They encountered the experiments' stimuli in a computer screen and we collected their silent reading times for one-word sentences. Items were screened one by one by pressing a key on the computer. Participants pressed the computer key and stopwatch key at the same time and pressed stopwatch key again to collect their inside reading time. Another trial started after recording the data. 10 items were displayed per participant. Items were the longest ones from the list prepared for the main experiment. The mean value of the study was 594 milliseconds. The result of this study suggested the use of 600 milliseconds as prime duration for our third experiment, which is explained in the following part.

In another auxiliary study, we aimed to come up with a list of related and unrelated target locational word pairs. To this end, we used a questionnaire. Verbs which were selected for the next experiments (those with 600 and 900 milliseconds prime durations) were matched with related locational names. Participants were instructed to write at most five related locational names, sorting them from most related to least related. 24 people participated in this study. 5 of them were omitted since the answers of the participants were not locational arguments. The questionnaire and results are given in Appendix A. The selected verbs and related target words are presented in the following section.

3.4 Experiments with 600 and 900 milliseconds prime durations

In experiments with 600 and 900 milliseconds priming duration, new experimental stimuli were prepared using the results of the pre-experiments. Related and unrelated target words were chosen according to the results the questionnaire mentioned above. The grammatical tense-aspectual markers were added and habitual aspect markers (*-Ir* and *-Ir-DI*) were omitted. The following inflectional markers were used: *-Iyor (present continuous)*, *-DI (perfect/past perfective)*, *-Iyor-DI (past continuous)*, and *–mIş-DI (past perfect/past in the past)*. The addition of *-mIş-DI* was intended to allow pairwise comparisons with Ferretti et al.'s (2007) first experiment, which involved a past perfect form (*had ... -ed*). We included *–Iyor* and *–DI* to check the difference between present and past tenses. Additionally, verbs roots used as primes were evenly distributed among different aspectual classes (states, activities, achievements and accomplishments)

Experiments with 600 and 900 milliseconds of priming duration had similar methodologies except the difference in prime duration. The mistakes with the offset strategy in the 600 milliseconds experiment were fixed in the 900 milliseconds experiment.

In our main experiment with 900 milliseconds prime duration, we wanted to further control the effect of relatedness. In previous experiments with shorter prime durations no effects were observable for relatedness and tense markers.

In the 900 milliseconds condition experiment, a person's participation was accepted if all the response times could be recorded. If there was a fail in the recording process or a misspelling, the participation was rejected. The values outside +/- 3*variance were changed with the values of the same relatedness category's mean.

3.4.1 Method

The stimuli consisted of priming words and target words. Priming words were verbs with tense-aspect markers in third person singular (null) agreement (e.g., *piş* 'cook', *giy* 'dress'), and target words were nouns that name locations (e.g. *mutfak* 'kitchen', *yol* 'road').

Participants: 30 people participated in the experiments. All participants were native Turkish speakers among Middle East Technical University students. Gender of the participants was equally distributed among males and females.

Materials: Two lists were created using previously selected 20 verbs and nouns that were acquired by the relatedness questionnaire. Each list had 4 sub-lists in which an offset strategy was applied to increase the variation of tense-aspect markers among participants. The offset strategy is the same as the one presented in 150 and 250 milliseconds conditions.

The two lists differed from each other with reference to target words' relatedness. The first list contained related target locational nouns for the first 10 items, and unrelated locational nouns for the last 10 items. In the second list, unrelated nouns were matched with the first 10 items, and related nouns were matched for the last 10 items. See Table 4 below for verb-locational nouns pairs in related and unrelated conditions.

Table 4 Items used in 600 and 900 milliseconds conditions

Verbs	**Related Target Words**	**Unrelated Target Words**
1. yak	orman	deniz
2. bas	matbaa	gökyüzü
3. vur	stad	müze
4. kuru	balkon	banka
5. bık	ofis	tarla
6. boya	ev	orman
7. piş	mutfak	podyum
8. göm	mezarlık	mağaza
9. giy	mağaza	mezarlık
10. alış	işyeri	poligon
11. dur	durak	bozkır
12.otur	kafe	pazar
13. yat	otel	durak
14. uzan	sahil	podyum

Verbs	Related Target Words	Unrelated Target Words
15. bil	okul	kamp
16. koş	spor salonu	kütüphane
17. yürü	sokak	gökyüzü
18.oku	kütüphane	tarla
19. yüz	havuz	banka
20. uç	havaalanı	havuz

Verbs were selected to be distributed evenly among different aspectual classes: states, activities, achievements and accomplishments, as shown in Table 5 below.

Table 5 Aspectual classes of items used in 600 and 900 milliseconds conditions

	achievement	accomplishment	stative	activity
1	yak	boya	dur	koş
2	bas	piş	otur	yürü
3	vur	göm	yat	oku
4	kuru	giy	uzan	yüz
5	bık	alış	bil	uç

Filler trials were included in the trials which included 20 unrelated verb-noun pairs. For all participants same filler list was used (see Table 6).

Table 6 Filler Trial Items for 600 and 900 milliseconds condition

No	Verbs	Target Words	No	Verbs	Target Words
1	anla	cami	11	dinle	daire
2	del	hamam	12	inan	depo
3	sık	saha	13	sor	kampüs
4	büyü	sirk	14	sev	mahkeme
5	don	köy	15	tanı	ova
6	ağla	otopark	16	üşü	market
7	eri	gar	17	dön	hastane
8	sat	lokanta	18	bul	vadi
9	avun	köprü	19	öp	ahır
10	yay	stüdyo	20	tut	fabrika

Also, a practice trial was prepared with twenty items (see Appendix B).

Procedure: Stimuli was presented on a 15.4 inch Lenovo G530 notebook using E-Prime software (version 2.0.8.90). The priming paradigm used was short stimulus onset asynchrony (SOA). Each trial was composed of a fixation point (+) for 250 milliseconds, priming sentence (e.g. *koşuyor 'is running'*) (for 600 milliseconds in one experiment and 900 milliseconds in the other), and a target locational noun (e.g. *orman* 'forest') for 1000 milliseconds. Experiments lasted around 6 minutes for a participant.

The instructions were: (1) read inside the word that appears after the fixation point (in 600/900 milliseconds threshold), (2) read aloud the second word to the microphone as soon as possible.

Vocalization response times were recorded via a microphone connected to serial response box of E-Prime software. Vocal responses were not recorded. All participants were attended to a practice session before the experiment.

The effect of memory span of individuals to attentional tasks is a known fact in psychology literature. Thus, we collected participants' backward digit span (BDS) scores before starting experiment sessions. The task was applied verbally. Instructor asked participants to repeat the numbers presented in reverse order. Decimal amount was increased with successive repetition. If a participant

repeated the number wrong two times, the decimal place was recorded as participant's score. Participants were divided into two groups; high span and low span participants (i.e. span score 6 or lower would be low span group, 7 or higher would be high span group).

There was a mistake in the implementation of the offset strategy in the 600 milliseconds priming condition experiment, because of wrong property selections on the software. The error was realized after the experiment, while mining the data, so could not be interfered. The results were analyzed with only the reliable data at hand and these were used to shed light into a new design with 900 milliseconds priming duration.

3.4.2 Hypotheses

Hypotheses related to 600 milliseconds and 900 milliseconds experiments were the same, as stated below.

Following the results of Ferretti et. al. (2007), we hypothesize that verbs in past imperfective form (*–Iyor-DI)* will have more priming effect for locational words than past perfect/perfective form (*–mIş-DI*) (see Literature Review section).

H1: *The mean reaction time with items in past imperfective form (-Iyor-DI) will be shorter than that with items in past perfect/past in the past form (-mIş-DI) under related word pairs condition.*

If the imperfectivity hypothesis is correct, it should also make a similar difference between past imperfective and simple (perfective) past:

H2*: The mean reaction time with items in present imperfective form (-Iyor-DI) will be shorter than that with items in present perfect/simple past form (-DI) under related word pairs condition.*

As with the previous experiments with 150 and 250 milliseconds prime conditions, we wanted to see whether tense (present vs. past) would have an effect on the priming of latent locational arguments. Our idea was that present time reference would evoke more accessible situation models than past time reference, due to the effect of proximity to the communicative situation. Hence, present forms would create faster reaction times than past forms:

***H3**: The mean reaction time with items in present imperfective form (-Iyor) will be shorter than that with items in past imperfective form (-Iyor-DI) under related word pairs condition.*

We also have the following two hypotheses about BDS scores, in line with the general findings in the literature:

***H4**: Difference in reaction times is expected for participants with different BDS scores*.

***H5:** Participants with high memory span will have smaller reaction times with respect to participants with low memory span.*

There is evidence that participant's semantic processing load is greater in sentences depicting durative, long-lasting and complex events than sentences depicting punctual and short events (Florit & Gennari, 2011; Schwanenflugel, 1991; Simpson, 1984). This is assumed to be so because of the excessive contextual associations of durative situations in the real word and in linguistic experiences (Moens & Steedman, 1988). In online language processing tasks, this diversity of associations is assumed to increase the cognitive load and hence make participants react slower. Following this explanation, we further hypothesize that this effect would be much more prominent for states than other durative classes (activities and accomplishments), because states typically denote more extension in time since they depict more stable situations. Accordingly, our hypotheses about aspectual classes are as follows:

***H6:** Participants will react slower to target locational words, regardless of relatedness of target words, when presented with a durative verb as compared to punctual verbs.*

***H7:** Non-stative verbs would activate locational names, regardless of relatedness of target words, as compared to stative verbs. We expect smaller reaction times for target words presented after non-stative verbs.*

Psycholinguistic literature established that word length is one of the main factors that affect reaction times in behavioral studies. Accordingly, we hypothesize that:

***H8:** Length of prime words affects reaction times. We expect smaller reactions times with shorter prime words as compared to longer ones.*

H9: *Length of target words affects reaction times. We expect smaller reactions times with shorter target words as compared to longer ones.*

H10: *We expect shorter reaction times when both prime and target words are shorter.*

3.4.3 Analysis methods

We applied three-way, two-way and one-way ANOVA analyses, with speech response (naming latency) as the dependent variable. The three-way ANOVA consisted of between-participant and between-items factors to stabilize variance caused by alternating verb-noun pairs and participants across lists, relatedness, and aspect type. Two-way and one-way ANOVA (analysis of variance) were applied with factors related to our hypotheses. Post-hoc tests (pairwise comparisons) were applied when the interaction needed further analysis. SPSS software was used for statistical analyses after collecting data with E-Prime software and mining in Microsoft Excel 2010.

CHAPTER 4

RESULTS

Results are given in this chapter in the order of the hypotheses presented in the previous chapter. Hypotheses were duplicated before related results.

Within the analyses, F-ratios of between-participants (i.e. taking mean values of dependent variable for a participant with respect to the factor analyzed) and between-items (i.e. taking mean values of dependent variable for items) analyses are presented with F_1 and F_2 abbreviations respectively.

4.1 Results of pre-experiments

4.1.1 150 milliseconds condition

At first the hardware setup was not trustable enough since the analysis of one-way ANOVA did not show any effect of tense markers used. Also relatedness had no effect on response times. Because of these results, between-participants and between-items analyses were not conducted. On the other hand the data analyzed for the effect of participants. One-way ANOVA did show the effect of participant with values $F(19, 177) = 5.045$ $p < .000$. This result was enough for us to continue with a new experiment setup.

Some of the participants reported that the prime words were recognizable but it was fast that some trials were missed, meaning that the prime words could not be recognized. The overall conclusion was that the design should be revised to have longer prime durations.

4.1.2 250 milliseconds condition

The participant factor for 250 milliseconds prime duration was F (19, 180) = 6.428, p < .000. However one-way variance analysis did not show any significant effect of relatedness or grammatical aspect marker. Hence, new experiments with 600 and 900 milliseconds were designed with new stimuli, as explained in Chapter 3.

4.2 Results of 600 milliseconds condition experiment

One-way ANOVAs were applied to the data. The effect of tense markers could not be revealed (F (1, 596) = 1.409, p > .2). The overall effect of aspectual class was also not statistically significant (F (1, 596) = 1.840, p < .139). The effect of relatedness, although noteworthy, was not again statistically significant: F (1, 596) = 3.378, p < .067.

The effect of BDS scores of participants were statistically significant (F (5, 594) = 8.224, p < 000). Further analysis could be found in the next section.

We had to decline the results of 600 milliseconds condition since the offset strategy was wrongly applied: Participants saw same tense markers for particular items (more than 50% of the items). With this in mind, the effect of BDS score was very significant that we further analyzed the issue in the main experiment with 900 milliseconds prime duration.

Because of the declined data, the between-participants and between-items analyses were not conducted.

4.3 Results of the main experiment - 900 milliseconds condition

The main experiment was applied with the SOA design with 900 milliseconds prime duration. We now present our analyses in the order of hypotheses given in Chapter 3.

4.3.1 Results for H1, H2 and H3

H1: *The mean reaction time with items in past imperfective form (-Iyor-DI) will be shorter than that with items in past perfect/past in the past form (-mIş-DI) under related word pairs condition.*

***H2**: The mean reaction time with items in present imperfective form (-Iyor-DI) will be shorter than that with items in present perfect/simple past form (-DI) under related word pairs condition.*

***H3**: The mean reaction time with items in present imperfective form (-Iyor) will be shorter than that with items in past imperfective form (-Iyor-DI) under related word pairs condition.*

Between-participants analyses were conducted for each of these three conditions. Relatedness and tense type were found to be not interacting ($F < 1$). However in first case, there was a small interaction between relatedness and tense type F_1 $(1,116) = 1.281$ $p < .3$. No significant interaction was observed in any of these comparisons. All three hypotheses were rejected.

Between-items analyses were also conducted. No significant differences were found regarding any of the first three hypotheses. We still want to note that, in the second comparison (H2), tense is interacted with reactions times by values $F (1, 22) = 3.76$ $p < .065$. Present form (-Iyor) mean value is M= 471.2 with SE=10.35 and past form (-DI) mean value is M=499.6 with SE= 10.35. Pairwise comparison was conducted with Benferroni technique. The significance of the mean values for tense interaction is $p < .065$. The mean values of between-items analysis for comparison in H2 is presented in Figure 3 below.

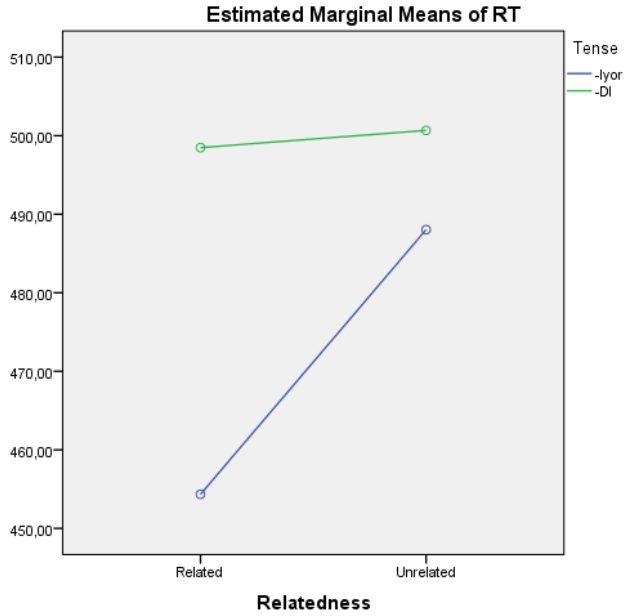

Figure 3 Mean values for –Iyor and –DI, between-participants values

4.3.2 Results for H4 and H5:

H4*: Difference in reaction times is expected for participants with different BDS scores.*

H5: *Participants with high memory span will have smaller reaction times with respect to participants with low memory span.*

One-way ANOVA is conducted without averaging the response time according to any category. The analysis revealed that there existed an interaction between back-ward digit span scores (F (4, 595) = 12.202 p < .000). Benferroni pairwise comparison was conducted. Mean values and their significance figures are presented in Table 7 below. Significant figures are circled.

Table 7 Pairwise comparison results for BDS scores with whole data

Pairwise Comparisons

Dependent Variable: RT

(I) BDS	(J) BDS	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
5,00	6,00	15,765	18,109	1,000	-35,257	66,787
	7,00	57,367*	18,109	,016	6,346	108,389
	8,00	55,967*	18,649	,028	3,421	108,512
	9,00	47,025	19,937	,187	-9,148	103,198
6,00	5,00	-15,765	18,109	1,000	-66,787	35,257
	7,00	41,603*	7,722	,000	19,847	63,358
	8,00	40,202*	8,916	,000	15,080	65,323
	9,00	31,260	11,366	,061	-,764	63,284
7,00	5,00	-57,367*	18,109	,016	-108,389	-6,346
	6,00	-41,603*	7,722	,000	-63,358	-19,847
	8,00	-1,401	8,916	1,000	-26,522	23,721
	9,00	-10,342	11,366	1,000	-42,366	21,681
8,00	5,00	-55,967*	18,649	,028	-108,512	-3,421
	6,00	-40,202*	8,916	,000	-65,323	-15,080
	7,00	1,401	8,916	1,000	-23,721	26,522
	9,00	-8,942	12,209	1,000	-43,341	25,457
9,00	5,00	-47,025	19,937	,187	-103,198	9,148
	6,00	-31,260	11,366	,061	-63,284	,764
	7,00	10,342	11,366	1,000	-21,681	42,366
	8,00	8,942	12,209	1,000	-25,457	43,341

Based on estimated marginal means

*. The mean difference is significant at the ,05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Significant mean differences exist from participants with scores 5 and 6 to participants with scores 7 and 8. Also two-way ANOVAs were conducted from BDS to relatedness, lexical classes, grouping of lexical classes and target word lengths. No significant figure was found.

Between-participants analysis was conducted with taking averages of participants' reaction times according to lexical classes. The results for the F figure was F (4, 115) = 4.8 $p < .001$. Pairwise comparisons resulted in similar relationships between the analyses above. The mean values presented with the Figure 4 below. Also two-way ANOVAs were conducted to search the interactions from BDS scores to relatedness, and groupings of lexical classes. No significant interaction was found between BDS scores and relatedness, and between BDS scores and lexical classes' categorizations.

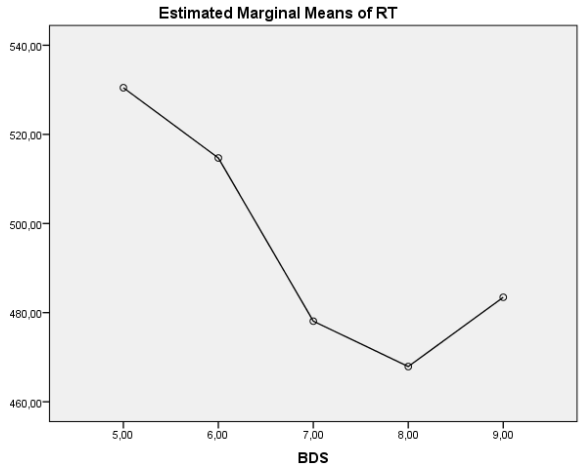

Figure 4 Mean values for different BDS scores, averaged by lexical items over participants

From the above figure, mean values have different levels with participants who has BDS score 7 or higher and 6 or lower. We pursued this issue with the following categorization: Participants were divided into two groups according to their memory span score. Participants with a span score 6 or lower would be low-span group, 7 or higher would be high-span group. One-way ANOVA was conducted to see the effect of BDS score groupings. The result is F (1, 118) = 18.111 $p < .000$. Benferroni pairwise comparison had significant value ($p < .000$). This means that high span participants were faster in their vocalization responses (M= 516.143 SE=7.66 for low span, M= 475.183 SE= 5.828 for high span). This result confirmed our fifth hypothesis (H5).

4.3.3 Results for H6

H6: *Participants will react slower to target locational words, regardless of relatedness of target words, when presented with a durative verb as compared to punctual verbs.*

Between-items analysis and between-participants analysis were conducted. No significant figure was acquired. Hence hypothesis 6 was rejected.

4.3.4 Results for H7

H7: *Non-stative verbs would activate locational names, regardless of relatedness of target words, as compared to stative verbs. We expect smaller reaction times for target words presented after non-stative verbs.*

Between-participants analysis was conducted. There were no interaction between relatedness and state vs. non-state distinction. However the general effect of stativity yielded significant figures: F_1 (1, 116) = 4.19 $p < .043$. Benferroni pairwise comparison was significant ($p < .043$) with mean values M= 496.02 SE= 5.69 for non-stative condition, M= 472.74 SE= 9.85 for stative condition. The mean values are presented in Figure 5 below.

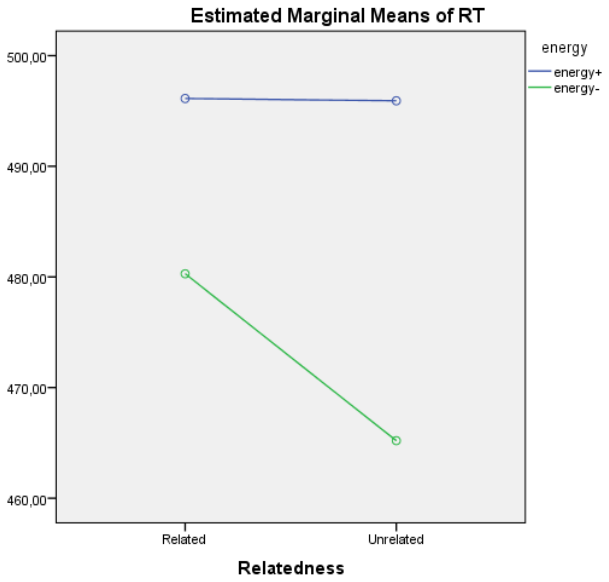

Figure 5 Mean values for stative (energy-) and non-stative (energy+) conditions, between-participants values

Between-items analysis was also conducted. The effect of state vs. non-state distinction was again significant with values F_2 (1, 156) = 7.9 $p < .006$. Pairwise Benferroni comparison was also significant ($p < .006$) with mean values M= 496.66 with SE= 4.14 for non-stative condition and M= 474.4 with SE= 7.17 for stative condition. There existed no significant interaction between relatedness and state vs. non-state categories.

The analyses above revealed that participants were faster in reacting to target words when they were primed with stative verbs, which is actually just the opposite of what we had hypothesized. Participants had an average delay 25 milliseconds with non-stative primes as compared to stative primes. Relatedness does not affect the reaction times within this classification. The mean values are presented in Figure 6 below.

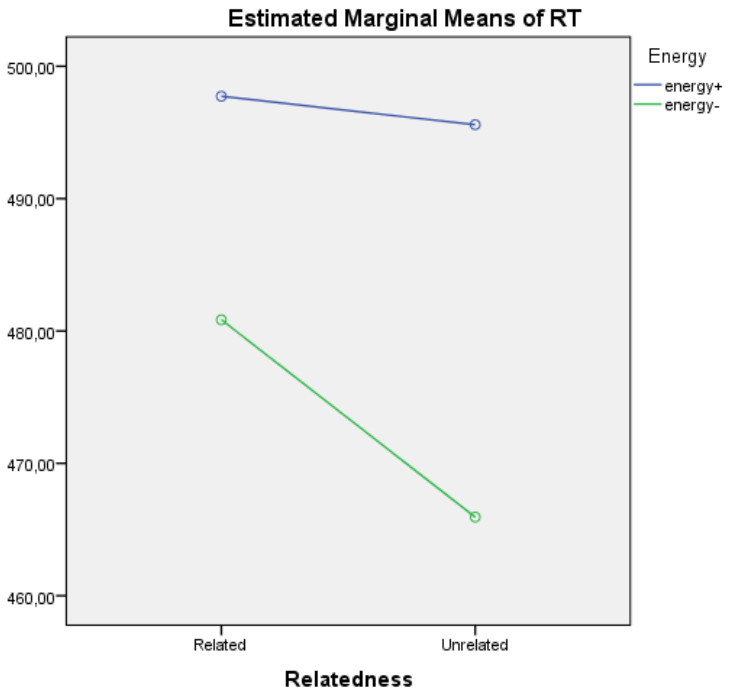

Figure 6 Between-items mean values for non-stative verbs (energy+) vs. stative verbs (energy-)

When the same analysis is done for comparing states with only achievements (punctual verbs), a similar pattern is observed, with F2 at 5,9 and $p < .015$. Here, participants reacted to stative verbs 22 milliseconds faster than to achievements.

Although contrary to our hypotheses, these are important results that will be discussed in Chapter 5.

4.3.5 Results of H8, H9, and H10

***H8**: Length of prime words affects reaction times. We expect smaller reactions times with shorter prime words as compared to longer ones.*

***H9**: Length of target words affects reaction times. We expect smaller reactions times with shorter target words as compared to longer ones.*

***H10**: We expect shorter reaction times when both prime and target words are shorter.*

Two-way ANOVA is conducted to search the interaction between prime and target word lengths. All experiment data is analyzed since the lengths of the prime and target words could not be matched within participants and items. No significant figure was acquired. Only the effect of target words' length has figure worth mentioning $F(7, 558) = 3.12$ $p < .003$.

We conducted another analysis after taking the average of the values according to target words' length. We applied one-way ANOVA and pairwise Benferroni comparison. F value for the effect of target words was $F(1, 6) = 28.54$ $p < .000$. The Benferroni comparison revealed that there existed pairwise interaction between items with length 2, 4, 5, and 6 and items with 8, and 11. 7-letter words interact only with 11-letter words. We defined two groups; short words and long words. Short group included 2, 4, 5, and 6-letter words and long group included 7, 8, and 11-letters words. One-way ANOVA was conducted to search the effects of short and long word groups. The grouping has significant interaction with F value $F(1, 12) = 8.58$ $p < .013$. If the same analysis was conducted with changing the group of 7-letter words into small length group, the F value decreased to $F(1, 12) = 7.597$ $p < .017$. The significance of F value was lost when we included words up to 5-letter into long group and words up to 8-letter into short group. When 6-letter and longer words were grouped as long ones, the values are $F(1, 12) = 6.263$, $p < .028$. One could conclude that items with length 6 and above have different reaction times

Pairwise comparison was conducted. The results were M= 480.76 SE = 9.243 for short group, M= 509.61 SE= 6.89 for long group. The values are presented in Figure 7 below:

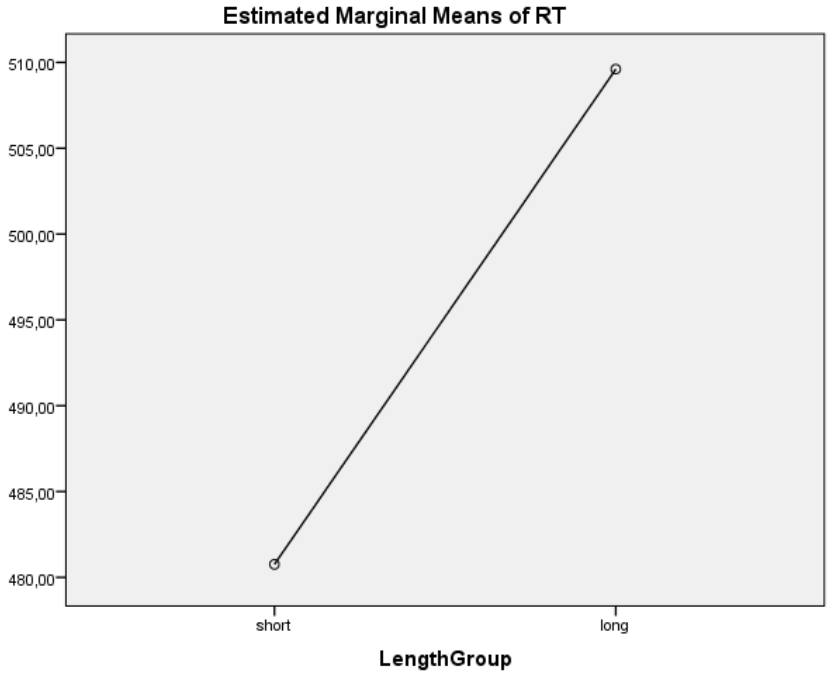

Figure 7 Mean values for short and long target word groups

Also we analyzed prime words' length. No significant value was found. H8 and H10 were rejected.

CHAPTER 5

DISCUSSIONS AND CONCLUSION

The present study replicated the following findings found in the literature: (1) Participants with higher memory span were capable to react faster to the pronunciation task. (2) The length of target words affected response times: The longer the verb was the longer the delay in reactions of participants.

Other than these, only the experiment with 900 milliseconds condition gave rise to some significant values, while others stayed inconclusive. We analyzed the 900 milliseconds condition in detail to verify our hypotheses. The most prominent result of the study was that the aspectual class of Turkish verbs affected the response times of participants. Participants were faster at reacting to stative verbs than non-stative ones. This will be discussed below, after we present some comments on our failure to replicate the finding of Ferretti et al. (2007) that imperfective aspect primes latent locational arguments.

5.1 No effect due to aspect and tense markers

In our main experiment, *–Iyor-DI* (past imperfective) and *–mIş-DI* (past perfect/past in the past) markers did not exhibit any significant difference as to the priming times of locational information. Similarly, no significant pattern was observed with *–Iyor* (present imperfective) vs. *–DI* (simple/perfective past).

We suggest that this result is primarily related to the difference between Turkish *–Iyor* and English *-be ... ing* markers. As stated in Section 2.2.2, *–Iyor* is not, strictly speaking, a *progressive* marker but a *continuous* marker, since it can be used with stative verbs. Progressive strategies like English *be ... ing* highlights the ongoingness of non-stative durative events (achievements and accomplishments) on the reference time. But continuous markers are not specifically associated with

this effect, as they also appear with states which already imply temporal extendedness on their own.

Another difference is that in Turkish, tense-aspect markers appear as suffixes. Hence, verbal root comes before the tense-aspect markers. This order is the reverse in English. In Ferretti et al.'s experiment, the grammatical aspect triggers the activation of aspectual cue at first sight, but in Turkish this is not the case. We suggest that in English, the first encountered aspectual cue dominates the processing, and vice-versa in Turkish. It is hence probable that participants' cognitive loads due to the processing of the verbal root block the effect of tense markers.

5.2. The effect of aspectual class: statives vs non-statives

In our main experiment with 900 milliseconds priming time, we found that the effect of stative versus non-stative aspectual classes was significant. The general conclusion is that aspectual class has an effect on the activation of locational information in situation models. Participants were faster to react to locational nouns following a verb describing stative events, as compared to those that describe events which denote a change of state (achievements, activities and accomplishments). When states were compared to only achievements (punctual verbs), again, states yielded faster reaction times.

This latter result may appear to be conflicting with the results of Gennari & Florit (2011), who assert that durative verbs take more processing time as compared to punctual ones (achievements). Indeed, following their findings, we had hypothesized that with states would increase the cognitive load and hence would increase reaction times.

This difference may be linked to the type of response elicited in the two works. Florit & Gennari (2011), in their Study 1, provided participants with full VPs like *admirar a un escritor famoso* ('to admire a famous writer') and asked them to provide sensicality judgments, which requires a deeper level of semantic processing as compared to priming. In contrast, the task in our experiment was to vocalize a target word, which is a priming task requires relatively shallower processing. Indeed, Florit & Gennari (2011, p.56) already admit that "it is possible that judgment times reflect rapid inferences or decision-making processes in providing sensicality judgments and therefore may not reflect natural reading comprehension."

A comparison with Florit & Gennari's (2011) tasks 2 and 3 with the current study would be particularly interesting, since these two tasks use the Spanish progressive marker *-ía,* which is functionally very close to Turkish continuous marker *-Iyor:* Both markers could be used with stative verbs unlike English progressive strategy. However, in these tasks the authors asked participants to read full sentences within a discoursive context (Study 2) and without a discoursive context (Study 3). These also apparently involve deeper cognitive processing than that involved in the current study (i.e., vocalizing a target word).

Their Study 4 was only designed to confirm their assumption that durative verbs are taken by participants to refer to events with longer duration as compared to non-durative events, hence is irrelevant to the present study. Finally, their Study 5 only showed that states elicit retrieval of more diverse types of knowledge, hence have more associations.

We suggest that the findings of the current study regarding states vs. non-stative verbs distinction are not incompatible with the results of Florit & Gennari (2011). In particular, although "the more diverse associations" of states may retard sensicality judgments or reading times for texts, it may perfectly ease semantic priming of locations, which is one of the most fundamental and even necessary participant of a stative situations.

This issue can also be discussed in terms of on-line and off-line language processing tasks. An off-line language processing task is a study where participants use their working memory consciously, for instance when a judgment is necessary. In contrast, on-line processing tasks tap on participants' subconscious processes. Although Florit & Gennari (2011) describe their experimental studies as on-line processing tasks, they can be seen to be closer to off-line tasks. We argue that in their experiments, the complexity of the data they presented to participants (VPs, sentences or text) as well as the type of response they asked from participants creates additional processes (i.e. more features and inferences related to the situation model) may interfere with reaction times.

In general, we believe that our result makes it necessary to have a closer look at how priming tasks interact with the use of cognitive resources.

5.3 Threshold

The experiment was applied with 150 and 250 milliseconds prime durations before increasing prime duration to 600 and 900 milliseconds. We hypothesized

according to Sahin et al.'s (2009) findings that there could be parallel processes which activates situational models just after retrieving verbs from visual areas or temporal lobes. This retrieval process occurs between 100 and 200 milliseconds and peaks around 150 milliseconds (Sahin et al., 2009). Also other findings about word identification state that identification occurs around 170 and 250 milliseconds (Indefrey, 2004; Marinkovic et al., 2003; Gaillard et al., 2006, cited in Sahin et al., 2009). Visual word form areas and left middle temporal lobe are shown to be integrated with Broca's area which is a known region of brain which specialized in language related processes (see Sahin et al., 2007 for visual word form area and Broca's area phase lock; see Sahin et al., 2007 and Friederici, 2009 for Broca's and temporal lobe's relation, cited in Sahin et al., 2009).

We could not replicate our results or Ferretti et al.'s result with shorter prime durations. This is presumably because we did not consider onset processes of speech act in a naming task, which are shown to occur at around 600 milliseconds (Indefrey, 2004, cited in Sahin et al., 2009).

If there exist parallel processes that activate event knowledge after verbs are identified, these processes should occur after identification (170 – 250 milliseconds) and could be vocalized after an additional 600 milliseconds.

Future studies should consider 750 milliseconds as a minimal threshold and even around 850 milliseconds to obtain significant results in similar priming studies.

5.4 Memory Span Effect

We showed that memory span of the participants affects the response times (i.e. participants with high memory span reacts faster in vocalization tasks). We propose that future studies must consider this issue while choosing participants. Especially when we consider between-participants (i.e. taking averages of items with respect to lexical classes within participant) analysis of memory span scores we found considerable effect with values F_1 (4, 115) = 4, 8 $p < .001$. This means that participants with high memory span could unfold effects that could not be seen with low memory span participants. Future studies should control this issue within their participants and organize their experiment sessions accordingly.

5.5 Lexical/contextual associations or lexical frames?

Another key to understand this apparent discrepancy between our results on stativity with that of Florit & Gennari (2011) would be the source of the priming

effect: We suggest that what is activated in our experiment is the general, abstract situational frame of the verb, rather than its lexical or specific-contextual associations.

It is generally assumed that situation models are specific to context. From Florit & Gennari:

"Following previous work on event representations, we argue that these representations are situation-specific in that they are dependent on the linguistic and situation context in which they occur, rather than being invariably attached to a lexical item (Ferretti, McRae, & Hatherell, 2001; McRae, Ferretti, & Amyote, 1997; McRae, Hare, Ferretti, & Elman, 2001)."

Florit and Gennari (2011) hypothesize that probability and contingency of situations with respect to their contexts, affect the semantic decision processes. They define probability as the likelihood of the occurrence of the situation in the real word, and contingency as the contextual connectedness to other situations in narratives. Hence probable events and events with more contingency relations are processed more quickly. Also they replicated the findings of Moens & Steedman (1988) that punctual events have well-formed contingent relationships with other events and longer (durative) events have more diverse relations with other events.

However, in most SOA experiments on this topic, including ours, inflected verbs are presented in isolation, without any discursive contexts. In the current work, we looked at *micro level* properties of situation models. We argue that locational information, as a micro level property, can be activated in generic situation models independent of lexical or contextual (experiential or discursive) associations. In other words, the activation is due to semantic memory, specifically, general lexical representations of verbs. (This can only be seen as a special case of associative priming, motivated by syntactic context, as defined in section 2.5) We consequently argue that spreading activation account does not explain the relevant priming effect. This argument, which is also endorsed by Ferretti et al (2007) (see section 2.6), is supported by our result that relatedness between prime verbs and target locational nouns did not have any effect on response times. In Turkish, aspectual class, which is an inherent property of verbs, seems to have an effect on the activation of this generic situation model, whereas external aspect (imperfective vs perfective) or tense (present vs. past) do not.

Also the items in the experiment should be balanced according to their frequencies. The prime and target words should be analyzed with respect to their occurrence frequencies and the experiment items should be balanced accordingly. Especially when tense and aspect markers are included, some items could be very less frequent with respect to suffixed tense and aspect markers. This situation should be controlled while designing experiments. This approach would make the study in line with one of the most successful theories of reading aloud, which is a model of converting printed words into sounds; the dual route cascaded model (Coltheart et al., 2001).

5.6 Limitations and suggestions for future research:

E-Prime software was used to present experimental stimuli and to record response times. If the sensitivity of the setup is less than 5 milliseconds or 10 milliseconds (for instance 11 milliseconds) the difference in means cannot be determined. For example, for 11 milliseconds error amount, the response time can vary 22 milliseconds (plus 11 milliseconds to one trial, minus 11 milliseconds to another trial) which is one millisecond more than the value obtained in Ferretti et al. (2007) as primed duration (for related target locational words with respect to unrelated ones under imperfective aspect condition).

Despite the result of our study which states that reading 10-11 letters long words take around 600 milliseconds to read the word silently, the difference between the results of statistical analysis of 600 and 900 milliseconds conditions gave rise to the idea that experimental studies in Turkish must consider longer time frames particularly when verbs are a part of a design. Especially when tense and personal designation morphemes are used, the semantic complexity of the text is increased, so that more duration is required for text processing.

As in the findings of the written word tasks, the length of the target words is very important. We replicated this finding with significant values. However, we could not duplicate the length effect for words used as prime. Also there is no association between the length of prime and target words. For a disciplined experiment design one must set the target words length to a reasonable character amount and control the aspectual class and grammatical aspect factors separately. Also BDS scores of the participant can be manipulated so that high-span participants and low-span participants can be experimented separately. We believe that this kind of categorization would enhance the results in hand and reveal further findings.

Using both grammatical markers and lexical aspect types simultaneously might make the grammatical marker's effect overlapped by lexical aspect. We propose for future studies that lexical aspect should be researched further and should be separated from other features of verbs to investigate pure effect of aspectual classification. One should also keep in mind that continuous aspect markers, different from strictly progressive markers, may lack an effect on spatial features of situation models.

The verbs used as primes should be balanced with respect to transitivity (causal complexity) since some verbs could differ in aspectual class when used in transitive form or intransitive form. In addition to that verbs should be balanced with respect to monomorphemic/polymorphemic distinction. Verbs should also be balanced with respect to event that they describe (i.e. mental or physical). The stative aspectual class' items in the experiment include 4 physical and 1 mental verbs. When we analyze this distinction, there exists valuable effect with values $F(1, 148) = 3{,}193$ $p < .076$. Participants are faster to react physical verbs (*dur, otur, yat, uzan*) than mental verbs (*bil*).

The difference in reaction times to stative verbs and the difference in physical/mental verbs within stative verbs should be researched further under consideration of spatial language. Some theories of language learning states that some components (e.g. agent vs. patient, source vs. goal) should be more prominent than others (i.e. goals are more prominent than sources). This kind of prominence relationships are used to map conceptual structure and syntax (Fisher, 1996; Grimshaw, 1981; Pinker 1989, cited in Lakusta et al., 2007). Locations could be one of the prominent property of language that are associated with verbs related to spatial language. This kind of prominence relationships could be seen pre-linguistically (see Lakusta et al., 2007 for source-goal asymmetry in infants). This asymmetry could also be seen in deaf children who have no exposure to conventional language (Zheng & Goldin – Meadow, 2002, cited in Lakusta et al., 2007).

The ideas presented here need further research based on more elaborate theoretical frameworks.

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APPENDICES

APPENDIX A – Questionnaire results for determining related locational names

		Questionnaire results for determining related locational names							
		1. Yakmak	**2. Basmak**	**3. Vurmak**	**4. Kurumak**	**5.Bıkmak**	**6.Boyamak**	**7.Pişmek**	**8.Gömmek**
Katılımcı 1	Kelime 1	itfaiye	yayinevi	spor salonu	ip	ofis	ev	mutfak	bahce
	Kelime 2		kutuphane	saha	makine	isyeri	oda	firin	mezarlik
	Kelime 3			bahce	bahce	metro	ofis	ocak	
	Keliem 4			ev	balkon	otobus	kagit	restoran	
	Kelime 5					sokak	anaokulu	kamp	
Katılımcı 2	Kelime 1	Hastane	Merdiven	Bar	Çamaşırhane	Otobüs	Apartman	Restaurant	Mezar
	Kelime 2	Sağlık Ocağı	Matba	Karete Salonu	Kuru Temizleme	AVM	Anaokulu	Yemekhane	Tarla
	Kelime 3	Boş Arazi	Kütüphane		Ev (Konut)	Kafe	Araba	Mutfak	
	Keliem 4	Apartman	Kırtasiye						
	Kelime 5	Çöp Kutusu	Tekstil						
Katılımcı 4	Kelime 1	Ev	Matbaa	Poligon	Balkon	Okul	Kreş	Lokanta	Mezarlık
	Kelime 2	orman		Karakol			Ev	Yemekhane	Bahçe
	Kelime 3	okul					Okul		Orman
	Keliem 4	kütüphane							
	Kelime 5								
Katılımcı 5	Kelime 1	orman	zemin	ring	tarla	okul	ev	lokanta	tarla
	Kelime 2	araba	merdiven	poligon	çamaşırhane	ofis	köy okulu	ekmek fırını	mezar
	Kelime 3	ev	yol	futbol sahası	çöl	halk otobusu	araba	cehennem	saksı
	Keliem 4	ifaiye aracı							
	Kelime 5	toma							
Katılımcı 6	Kelime 1	Orman	Yatak Odası	Ring	Dere	Taşra	Ev	Mutfak	Mezarlık
	Kelime 2	Tren Garı	Atari Salonu	Spor Salonu	Bataklık	Banka Şubesi	Fabrika	Restoran	Bahçe
	Kelime 3	Çöplük	Stadyum	Hapishane			Sanat Evi	Kafeterya	Kumsal

		Questionnaire results for determining related locational names							
		1. Yakmak	**2. Basmak**	**3. Vurmak**	**4. Kurumak**	**5.Bıkmak**	**6.Boyamak**	**7.Pişmek**	**8.Gömmek**
	Keliem 4	Bahçe		Orman			Okul		
	Kelime 5			Trafik					
Katılımcı 7	Kelime 1	Orman	Merdiven	Tribün	Balkon	Kreş	Oda	Mutfak	Arazi
	Kelime 2	Ev	Kaldırım	Ring	Banyo	Okul	Ev	Restoran	Nehir
	Kelime 3	Otobüs	Halı Saha	Stadyum	Kiler	Üniversite	Gemi	Büfe	Plaj
	Keliem 4	Otomobil	Zemin	Huzurevi	Plaj	İşyeri	Araba	Kafeterya	Kale
	Kelime 5	Tarla	Oda	Yetimhane	Avlu	Şehir	Uçak	Kafe	Kilise
Katılımcı 8	Kelime 1	orman	kumarhane	okul	balkon	ofis	ev	mutfak	mezarlık
	Kelime 2	ev	genelev	cezaevi	çamaşırhane	spor salonu	kreş	yemekhane	bahçe
	Kelime 3	otel	matbaa	cami	bahçe	lokanta	oto servisi	lokanta	
	Keliem 4								
	Kelime 5								
Katılımcı 9	Kelime 1	orman	tarla	şehir	göl	işyeri	sokak	mutfak	mezar
	Kelime 2	ofis	ülke	orman	hava	mezar	ev	ekmek fırını	bahçe
	Kelime 3	ev	ay	yol		kesimhane	fabrika	lokanta	banka
	Keliem 4	tarla						piknik alanı	
	Kelime 5	tarihi bina							
Katılımcı 10	Kelime 1	kamp	toprak	orman	çamaşırhane	mutfak	oda	mutfak	toprak
	Kelime 2	otel	park	spor salonu	park		ev	lokanta	mezarlık
	Kelime 3		çim alan					restorant	
	Keliem 4								
	Kelime 5								
Katılımcı 11	Kelime 1	bahçe	matbaa		balkon		ev	mutfak	mezarlık
	Kelime 2	piknik alanı						yemekhane	bahçe
	Kelime 3								
	Keliem 4								
	Kelime 5								
Katılımcı 12	Kelime 1	orman	matbaa	poligon	çöl	ofis	yeni ev	gözlemeci	mezarlık
	Kelime 2	çöplük			bozkır	okul			hazine
	Kelime 3					vezne			ruins
	Keliem 4								
	Kelime 5								
Katılımcı 13	Kelime 1	ev	matbaa	saha	çamaşırhane	okul	atölye	ev	mezarlık

		Questionnaire results for determining related locational names							
		1. Yakmak	**2. Basmak**	**3. Vurmak**	**4. Kurumak**	**5.Bıkmak**	**6.Boyamak**	**7.Pişmek**	**8.Gömmek**
	Kelime 2	kahvehane	atölye	ev	balkon	yemekhane	ev	yemekhane	bahçe
	Kelime 3	kıraathane	fabrika	okul	ev	ofis	bina	restaurant	
	Keliem 4	kibrit fabrikası			fabrika			iş yeri	
	Kelime 5	tarla						lokanta	
Katılımcı 14	Kelime 1	ev			çamaşırhane	iş yeri	ev	mutfak	mezarlık
	Kelime 2	otel					kreş / yuva	lokanta	bahçe
	Kelime 3	hastane					okul	cafe	
	Kelime 4	köy					oda		
	Kelime 5	orman					atölye		
Katılımcı 15	Kelime 1	Orman	Yol	Futbol maçı	Orman	Opera	Duvar	Mutfak	Mezarlık
	Kelime 2	Ev	Kaldırım	Mahalle	Bahçe	Tiyatro	Sokak	Cafe	
	Kelime 3	Gemi	matbaa	Piyango	Ev	AVM	Ev	Restaurant	
	Keliem 4	Mutfak	Postane		Şömine önü		Atölye		
	Kelime 5	Çöplük							
Katılımcı 16	Kelime 1	ev	ev	hapishane	çamaşırhane		ev	mutfak	mezarlık
	Kelime 2	gemi	sokak	sokak	balkon		okul	yemek salonu	morg
	Kelime 3			meyhane	teras		oda	piknik alanı	hastane
	Keliem 4			fitness merkezi			mutfak		cami
	Kelime 5			boks salonu			apartman		cenaze evi
Katılımcı 17	Kelime 1	harabe	iddia bayi	dağ	tarla	ev	inşaat	restoran	mezarlık
	Kelime 2	orman	mekan	karakol	sera	yeri	sergi	cafe	orman
	Kelime 3	ev	yayınevi	sirk	baraj	okul	hırdavatçı	ev	türbe
	Keliem 4	fabrika	ptt	okul	göl	dünya	ev	mesire alanı	mesire al.
	Kelime 5	mesire alanı	pavyon	poligon	havuz			kumsal	
Katılımcı 18	Kelime 1	orman	ev	karakol	orman	okul	yuva	mutfak	mezarlik
	Kelime 2			ev	bahce	ev	ev	restrant	orman
	Kelime 3			hapishane		oda		lokanta	
	Keliem 4							yemekhane	
	Kelime 5							kantin	
Katılımcı 19	Kelime 1	kömür ocağı	mekan	karakol	sahil	işyeri	atölye	yemekhane	mezarlık
	Kelime 2	ev	kanalizayson	ring	çamaşırhane	okul	ev	mutfak	tarla
	Kelime 3	yurt	köprülü kavşak	otoyol	ev	otoyol	fabrika	sahil	

		Questionnaire results for determining related locational names							
		1. Yakmak	**2. Basmak**	**3. Vurmak**	**4. Kurumak**	**5.Bıkmak**	**6.Boyamak**	**7.Pişmek**	**8.Gömmek**
	Keliem 4	tarla	cadde						
	Kelime 5		kaldırım						

		Questionnaire results for determining related locational names (cont.)							
		9. Giymek	**10.Alışmak**	**11. Durmak**	**12.Oturmak**	**13.Yatmak**	**14.Uzanmak**	**15. Bilmek**	**16. Koşmak**
Katılımcı 1	Kelime 1	yatak odasi	sehir	otobus duragi	oturma odasi	yatak	sahil	kutuphane	cadde
	Kelime 2	ev	isyeri	sinema onu	yatak odasi	sofa	ev	okul	saha
	Kelime 3	balo	okul	cadde	ofis	koltuk	koltuk	topluluk/kulup	sokak
	Keliem 4	davet	topluluk/kulup	sokak	toplu tasima araci	hamak	hayvanat bahcesi	yarisma salonu	anaokulu
	Kelime 5				kutuphane		anaokulu		bahce
Katılımcı 2	Kelime 1	Elbise Dolabı	Ev	Otobüs Durağı	Ev	Ev	Ev	Araştırma Merkezi	Stad
	Kelime 2	Mağaza	Kafe	Otobüs Terminali	Kafe	Otel	Sahil	Üniversite	Spor Salonu
	Kelime 3	Kabin	Araba	Hava Alanı	Araba	Yurt	Sinema Salonu	Kongre Salonu	
	Keliem 4							Kütüphane	
	Kelime 5								
Katılımcı 4	Kelime 1	Mağaza	Hapishane	Trafik	Ev	Oda	koltuk	Kütüphane	Parkur
	Kelime 2	Podyum		Durak	Apartman	Yatakhane	yatak		Koru
	Kelime 3					Otel	sahil		Orman
	Keliem 4								sokak
	Kelime 5								
Katılımcı 5	Kelime 1	bershka	ankara	otobus durağı	ofis	yatak odası	deniz	ankara	spor salonu
	Kelime 2	giyinme kabini	kurtuluş	banka	yemekhane	salondaki üçlü koltuk	doğa	mutfak	plaj
	Kelime 3	yatak odası	ev	yol	kahvehane	çimenlik	festival alanı	üniversite	futbol sahası
	Keliem 4								
	Kelime 5								
Katılımcı 6	Kelime 1	Yatak Odası	Şehir	Durak	Ofis	Ev	Sahil	Kütüphane	Parkur
	Kelime 2	Kabin	Ev	Otobüs	Kafe	Yatak Odası	Şehir	Oturma Odası	Spor Salonu
	Kelime 3		Trafik	Metro	Restoran	Otel	koltuk		Futbol Sahası
	Keliem 4			Dolmuş	Bar	Pansiyon			Basketbol Salonu
	Kelime 5				Bekleme Odası	Çadır			Sokak
Katılımcı 7	Kelime 1	Mağaza	İş yeri	İstasyon	Salon	Oda	Orman	Kütüphane	Koşu pisti
	Kelime 2	Ev	Kurs yeri	Park yeri	Lobi	Tekne	sahil	Laboratuvar	Stadyum
	Kelime 3	Soyunma Odası	Okul	Havalimanı	Kafe	Otel	yatak	Ev	Park

		Questionnaire results for determining related locational names (cont.)							
		9. Giymek	**10.Alışmak**	**11. Durmak**	**12.Oturmak**	**13.Yatmak**	**14.Uzanmak**	**15. Bilmek**	**16. Koşmak**
	Keliem 4	Terzi	Yetimhane	Otogar	Lokanta	Pansiyon		Okul	Spor Salonu
	Kelime 5	Spor salonu	Şehir	Liman	Park	Park		Üniversite	Orman
Katılımcı 8	Kelime 1	giyim dükkan	spor salonu	durak	ev	ev	ev	okul	park
	Kelime 2	spor salonu	tuvalet	yemekhane	bar	yatakhane	kreş	dersane	futbol sahası
	Kelime 3	terzi		hastane	sinema	otel	park		
	Keliem 4					hastane			
	Kelime 5								
Katılımcı 9	Kelime 1	avm	yatakodası	otoyol	tarla	yatakodası	park	arazi	yol
	Kelime 2	çadır	şehir	otobüs durağı	balkon	araba	boş arazi	uzay	bahçe
	Kelime 3	tuvalet	işyeri		sandal	sahil	sahil		spor salonu
	Keliem 4					orman			
	Kelime 5					park			
Katılımcı 10	Kelime 1	mağaza		otobüs durağı	sınıf	yatak odası	çim	kütüphane	stadyum
	Kelime 2	hastane		yemekhane	durak	park	sahil		orman
	Kelime 3	askeriye		metro	park	çim			kumsal
	Keliem 4								
	Kelime 5								
Katılımcı 11	Kelime 1	deneme kabini		durak	ev	yatak odası			parkur
	Kelime 2	oda		istasyon	kafe				
	Kelime 3								
	Keliem 4								
	Kelime 5								
Katılımcı 12	Kelime 1	AVM	gym	otobüs durağı	salon	yurt	Park	üniversite	göl kenarı
	Kelime 2	kayak merkezi	Ev	manzara	mobilyacı	otel	kumsal	iş yeri	otobüs durağı
	Kelime 3				komşu			konferans	gym
	Keliem 4								
	Kelime 5								
Katılımcı 13	Kelime 1	ev	okul	otobüs durağı	ev	yatak odası	sahil	okul	yol
	Kelime 2	mağaza	ofis	ofis	park	arkadaş evi	ofis	yarışma stüdyosu	park
	Kelime 3	avm		ev	avm	park	kantin	ev	spor salonu
	Keliem 4	terzi		okul bahçesi	çay bahçesi	otogar		iş yeri	
	Kelime 5	atölye		derslik		misafirhane		derslik	

		Questionnaire results for determining related locational names (cont.)							
		9. Giymek	**10.Alışmak**	**11. Durmak**	**12.Oturmak**	**13.Yatmak**	**14.Uzanmak**	**15. Bilmek**	**16. Koşmak**
Katılımcı 14	Kelime 1	soyunma odası	iş yeri	durak	salon	yatakodası	kumsal	okul	spor salonu
	Kelime 2	yatak odası	okul	kırmızı ışık /trafik?	lobi	salon	ev	dershane	kumsal
	Kelime 3	kabin			ofis	park / bank	havuz		
	Kelime 4	banyo					park		
	Kelime 5								
Katılımcı 15	Kelime 1	Ev	İşyeri	Durak	Ev	Yatak odası	çim	İş yeri	Parkur
	Kelime 2	AVM	Şehir		Muayenehane	Ev	Ev	Okul	Orman
	Kelime 3	Mağaza				TV karşısı			
	Keliem 4								
	Kelime 5								
Katılımcı 16	Kelime 1	deneme kabini	okul	okul	kafe	yatak odası	ev	kütüphane	sokak
	Kelime 2	kıyafet odası	iş yeri	araba	kütüphane	otel	kafe	okul	stadyum
	Kelime 3	alış veriş merkezi	devlet dairesi	kütüphane	yemekhane	hastane	orman	dersane	köprü
	Keliem 4				oturma odası	çimenlerin üstü	okul	kitapçılar	parkur
	Kelime 5				sinema		park		orman
Katılımcı 17	Kelime 1	mağaza	okul	durak	dolmuş	ev	sokak	okul	koşu yolu
	Kelime 2	avm	işyeri	fotoğrafçı	işyeri	otel	sahil	kütüphane	park
	Kelime 3	düğün salon	ev	berber	berber	kumsal	otel	kitapevi	spor salonu
	Keliem 4	kumsal	kumarhane	sinema	spor salonu	park	barınak	internet cafe	stadyum
	Kelime 5	cami	meyhane	tiyatro	kaldırım	istasyon	kışla		sokak
Katılımcı 18	Kelime 1	yatak odasi	ev	araba	ev	yatak odasi	sahil	okul	stadyum
	Kelime 2	avm	oda	meydan	salon	ev		universite	saha
	Kelime 3	magaza	okul		okul	yurt	oda	ev	spor salonu
	Keliem 4		sehir			yatakhane		yurt	orman
	Kelime 5					hapishane			
Katılımcı 19	Kelime 1	oda	işyeri	durak	ev	ev	sahil	sınav salonu	spor sahaları
	Kelime 2	avm	okul	otoyol	kafe	sahil	kumsal		cadde
	Kelime 3		şehir	cadde	park	otoyol			
	Keliem 4		ülke						
	Kelime 5								

		Questionnaire results for determining related locational names (cont.)			
		17.Yürümek	**18.Okumak**	**19. Yüzmek**	**20.Uçmak**
Katılımcı 1	Kelime 1	sokak	ev	havuz	gokyuzu
	Kelime 2	ev	isyeri	deniz	ruya
	Kelime 3	isyeri	bilgisayar	okyanus	
	Keliem 4	hapishane	toplu tasima araci	gol	
	Kelime 5			nehir	
Katılımcı 2	Kelime 1	AVM	Çalışma Odası	Havuz	Uçak
	Kelime 2	Fuar	Kütüphane	Salon	Balon
	Kelime 3	Pazar	Kitapçı		Helikopter
	Keliem 4		Üniversite		
	Kelime 5				
Katılımcı 4	Kelime 1	Kordon	Kütüphane	Deniz	Gökyüzü
	Kelime 2	Kaldırım	Kampüs	Havuz	
	Kelime 3	Kumsal	Okul	Göl	
	Keliem 4	Podyum			
	Kelime 5				
Katılımcı 5	Kelime 1	sahil yolu	kütüphane	havuz	gökyüzü
	Kelime 2	orman	koridor	deniz	uçak
	Kelime 3	hapishane	bekleme odası	göl	müzik festivali
	Keliem 4				
	Kelime 5				
Katılımcı 6	Kelime 1	Parkur	Kütüphane	Deniz	Hava alanı
	Kelime 2	Sokak	Çalışma Odası	Dere	Pist
	Kelime 3	Cadde	Oturma Odası	Havuz	Uçak
	Keliem 4		Yatak Odası	Mezbaahane	Helikopter
	Kelime 5		Kampüs		Zeplin
Katılımcı 7	Kelime 1	Orman	Salon	Havuz	Uçak
	Kelime 2	Sahil kenarı	Kütüphane	Deniz	Helikopter
	Kelime 3	Park	Ev	Nehir	Zeplin
	Keliem 4	AVM	Ofis	Göl	Planör
	Kelime 5	Meydan	Otobüs	Irmak	Mekik

		Questionnaire results for determining related locational names (cont.)			
		17.Yürümek	**18.Okumak**	**19. Yüzmek**	**20.Uçmak**
Katılımcı 8	Kelime 1	sokak	kütüphane	havuz	havaalanı
	Kelime 2		okul	deniz	yamaç
	Kelime 3			baraj	
	Keliem 4				
	Kelime 5				
Katılımcı 9	Kelime 1	orman	okul	havuz	hava
	Kelime 2	ev	bahçe	göl	
	Kelime 3	banka	anıt	akarsu	
	Keliem 4			su kanalı	
	Kelime 5				
Katılımcı 10	Kelime 1	sokak	kütüphane	havuz	havaalanı
	Kelime 2	orman	kitabevi	deniz	yuva
	Kelime 3	dağ	durak	dere	havalimanı
	Keliem 4	kumsal	kafe	göl	pist
	Kelime 5			nehir	
Katılımcı 11	Kelime 1	parkur	kafe	havuz	uçak
	Kelime 2	yol	kütüphane	deniz	
	Kelime 3		ev	göl	
	Keliem 4				
	Kelime 5				
Katılımcı 12	Kelime 1	sokaklar	kütüphane	deniz	havaalanı
	Kelime 2		kitapçı	yazlık	
	Kelime 3		kafe	gym	
	Keliem 4				
	Kelime 5				
Katılımcı 13	Kelime 1	yol	kütüphane	sahil	havaalanı
	Kelime 2	park	okul	yüzme havuzu	gökyüzü
	Kelime 3	bahçe	bahçe	aqua park	tarla
	Keliem 4	dağ	teras katı		
	Kelime 5	orman	ağaç dalı		
Katılımcı 14	Kelime 1	spor salonu	kütüphane	havuz	pist
	Kelime 2	park	okul	deniz	
	Kelime 3	sahil	dershane	ada	
	Kelime 4	sokak	ev		

		Questionnaire results for determining related locational names (cont.)			
		17.Yürümek	**18.Okumak**	**19. Yüzmek**	**20.Uçmak**
	Kelime 5		oda		
Katılımcı 15	Kelime 1	Orman	Kütüphane	Havuz	Uçak
	Kelime 2	Dağ	Ev	Spor merkezi	Balon
	Kelime 3	Yol	Oda	Deniz kenarı	
	Keliem 4				
	Kelime 5				
Katılımcı 16	Kelime 1	sokak	kütüphane	havuz	uçak
	Kelime 2	cadde	kültür kafeler	deniz	helikopter
	Kelime 3	parkur	ev	körfez	sıcak hava balonu
	Keliem 4	alış veriş merkezi	çimenlerin üstü	hamam	zeplin
	Kelime 5	orman	sınıf	ada	
Katılımcı 17	Kelime 1	sokak	kütüphane	havuz	havalimanı
	Kelime 2	sahil	okul	sahil	disko
	Kelime 3	sirk	kitapevi	hamam	harabe
	Keliem 4	orman	park	sirk	galata kule
	Kelime 5	dağ	metro		
Katılımcı 18	Kelime 1	orman	okul	spor salonu	ucak
	Kelime 2	park	universite	tatil koyu	havaalani
	Kelime 3	bahce	ev		ulke
	Keliem 4	stadyum			sehir
	Kelime 5				
Katılımcı 19	Kelime 1	kaldırım	kütüphane	yüzme havuzu	havaalanı
	Kelime 2	otoyol	okul	deniz	dağ yamacı
	Kelime 3	sahil		deri üretim atölyesi	
	Keliem 4				
	Kelime 5				

APPENDIX B – Practice trials for 600 and 900 milliseconds conditions

Prime	**Target**
düşün	teneke
tartış	zambak
öl	sebze
savun	elma
tüken	ateş
planla	palyaço
üret	saklambaç
hatırla	kauçuk
öğren	şemsiye
yönet	kardeş
eleştir	bilezik
üz	beyaz
öngör	sineklik
türe	zürafa
yen	karınca
doğ	makina
yansı	tabaka
ısın	sürahi
kazan	kitaplık
öde	süpürge

APPENDIX C – EXPERIMENT DATA (900 ms condition)

Experiment Data (900 ms condition)									
Partic.	**Prime**	**Target**	**RT (ms)**	**BDS**		**Partic.**	**Prime**	**Target**	**RT (ms)**	**BDS**
1	yakıyordu	orman	518	6		16	duruyordu	durak	558	6
1	basmıştı	matba	669	6		16	oturmuştu	kafe	487	6
1	vuruyor	stad	638	6		16	yatıyor	otel	513	6
1	kurudu	balkon	503	6		16	uzandı	sahil	531	6
1	bıkıyordu	ofis	526	6		16	biliyordu	okul	418	6
1	boyamıştı	ev	426	6		16	koşmuştu	spor salonu	753	6
1	pişiyor	mutfak	575	6		16	yürüyor	sokak	541	6
1	gömdü	mezarlık	758	6		16	okudu	kütüphane	535	6
1	giyiyordu	mağaza	534	6		16	yüzüyordu	havuz	433	6
1	alışmıştı	iş yeri	599	6		16	uçmuştu	havaalanı	524	6
1	duruyor	bozkır	484	6		16	yakıyor	deniz	504	6
1	oturdu	pazar	422	6		16	bastı	gökyüzü	488	6
1	yatıyordu	durak	556	6		16	vuruyordu	müze	578	6
1	uzanmıştı	podyum	589	6		16	kurumuştu	banka	448	6
1	biliyor	kamp	541	6		16	bıkıyor	tarla	541	6
1	koştu	kütüphane	565	6		16	boyadı	orman	474	6
1	yürüyordu	gökyüzü	544	6		16	pişiyordu	podyum	578	6
1	okumuştu	tarla	533	6		16	gömmüştü	mağaza	568	6
1	yüzüyor	banka	526	6		16	giyiyor	mezarlık	502	6
1	uçtu	havuz	517	6		16	alıştı	poligon	650	6
2	yakmıştı	orman	373	7		17	durmuştu	durak	450	7
2	basıyor	matba	474	7		17	oturuyor	kafe	587	7
2	vurdu	stad	409	7		17	yattı	otel	487	7
2	kuruyordu	balkon	469	7		17	uzanıyordu	sahil	617	7
2	bıkmıştı	ofis	395	7		17	bilmişti	okul	485	7
2	boyuyor	ev	476	7		17	koşuyor	spor salonu	668	7
2	pişti	mutfak	476	7		17	yürüdü	sokak	498	7
2	gömüyordu	mezarlık	432	7		17	okuyordu	kütüphane	515	7
2	giymişti	mağaza	483	7		17	yüzmüştü	havuz	437	7
2	alışıyor	iş yeri	439	7		17	uçuyor	havaalanı	453	7
2	durdu	bozkır	447	7		17	yaktı	deniz	501	7
2	oturuyordu	pazar	442	7		17	basıyordu	gökyüzü	515	7
2	yatmıştı	durak	313	7		17	vurmuştu	müze	516	7
2	uzanıyor	podyum	321	7		17	kuruyor	banka	467	7
2	bildi	kamp	352	7		17	bıktı	tarla	511	7
2	koşuyordu	kütüphane	445	7		17	boyuyordu	orman	553	7
2	yürümüştü	gökyüzü	434	7		17	pişmişti	podyum	510	7
2	okuyor	tarla	504	7		17	gömüyor	mağaza	499	7
2	yüzdü	banka	468	7		17	giydi	mezarlık	541	7
2	uçuyordu	havuz	484	7		17	alışıyordu	poligon	531	7
3	yakıyor	orman	427	6		18	duruyor	durak	529	6
3	bastı	matba	478	6		18	oturdu	kafe	489	6
3	vuruyordu	stad	416	6		18	yatıyordu	otel	636	6
3	kurumuştu	balkon	460	6		18	uzanmıştı	sahil	484	6
3	bıkıyor	ofis	400	6		18	biliyor	okul	309	6

Experiment Data (900 ms condition)									
Partic.	**Prime**	**Target**	**RT (ms)**	**BDS**		**Partic.**	**Prime**	**Target**	**RT (ms)**	**BDS**
3	boyadı	ev	497	6		18	koştu	spor salonu	548	6
3	pişiyordu	mutfak	425	6		18	yürüyordu	sokak	521	6
3	gömmüştü	mezarlık	446	6		18	okumuştu	kütüphane	271	6
3	giyiyor	mağaza	503	6		18	yüzüyor	havuz	348	6
3	alıştı	2	447	6		18	uçtu	havaalanı	518,5	6
3	duruyordu	bozkır	423	6		18	yakıyordu	deniz	616	6
3	oturmuştu	pazar	444	6		18	basmıştı	gökyüzü	785	6
3	yatıyor	durak	448	6		18	vuruyor	müze	523	6
3	uzandı	podyum	483	6		18	kurudu	banka	680	6
3	biliyordu	kamp	406	6		18	bıkıyordu	tarla	467	6
3	koşmuştu	kütüphane	534	6		18	boyamıştı	orman	471	6
3	yürüyor	gökyüzü	430	6		18	pişiyor	podyum	480	6
3	okudu	tarla	369	6		18	gömdü	mağaza	514	6
3	yüzüyordu	banka	554	6		18	giyiyordu	mezarlık	520	6
3	uçmuştu	havuz	428	6		18	alışmıştı	poligon	490	6
4	yaktı	orman	431	7		19	durdu	durak	583	7
4	basıyordu	matba	504	7		19	oturuyordu	kafe	583	7
4	vurmuştu	stad	574	7		19	yatmıştı	otel	586	7
4	kuruyor	balkon	417	7		19	uzanıyor	sahil	525	7
4	bıktı	ofis	416	7		19	bildi	okul	564	7
4	boyuyordu	ev	416	7		19	koşuyordu	spor salonu	602	7
4	pişmişti	mutfak	434	7		19	yürümüştü	sokak	530	7
4	gömüyor	mezarlık	541	7		19	okuyor	kütüphane	542	7
4	giydi	mağaza	457	7		19	yüzdü	havuz	575	7
4	alışıyordu	iş yeri	531	7		19	uçuyordu	havaalanı	598	7
4	durmuştu	bozkır	415	7		19	yakmıştı	deniz	479	7
4	oturuyor	pazar	391	7		19	basıyor	gökyüzü	524	7
4	yattı	durak	449	7		19	vurdu	müze	627	7
4	uzanıyordu	podyum	263	7		19	kuruyordu	banka	287	7
4	bilmişti	kamp	484	7		19	bıkmıştı	tarla	547	7
4	koşuyor	kütüphane	470	7		19	boyuyor	orman	528	7
4	yürüdü	gökyüzü	435	7		19	pişti	podyum	539	7
4	okuyordu	tarla	491	7		19	gömüyordu	mağaza	533	7
4	yüzmüştü	banka	396	7		19	giymişti	mezarlık	563	7
4	uçuyor	havuz	421	7		19	alışıyor	poligon	543	7
5	yakıyordu	orman	376	7		20	duruyordu	durak	475	6
5	basmıştı	matba	410	7		20	oturmuştu	kafe	614	6
5	vuruyor	stad	557	7		20	yatıyor	otel	466	6
5	kurudu	balkon	408	7		20	uzandı	sahil	517	6
5	bıkıyordu	ofis	392	7		20	biliyordu	okul	471	6
5	boyamıştı	ev	445	7		20	koşmuştu	spor salonu	570	6
5	pişiyor	mutfak	518	7		20	yürüyor	sokak	431	6
5	gömdü	mezarlık	466	7		20	okudu	kütüphane	495	6
5	giyiyordu	mağaza	474	7		20	yüzüyordu	havuz	373	6
5	alışmıştı	iş yeri	407	7		20	uçmuştu	havaalanı	614	6
5	duruyor	bozkır	433	7		20	yakıyor	deniz	514	6
5	oturdu	pazar	429	7		20	bastı	gökyüzü	471	6
5	yatıyordu	durak	400	7		20	vuruyordu	müze	515	6
5	uzanmıştı	podyum	421	7		20	kurumuştu	banka	545	6
5	biliyor	kamp	431	7		20	bıkıyor	tarla	469	6
5	koştu	kütüphane	348	7		20	boyadı	orman	454	6
5	yürüyordu	gökyüzü	463	7		20	pişiyordu	podyum	628	6
5	okumuştu	tarla	409	7		20	gömmüştü	mağaza	526	6

Experiment Data (900 ms condition)									
Partic.	**Prime**	**Target**	**RT (ms)**	**BDS**		**Partic.**	**Prime**	**Target**	**RT (ms)**	**BDS**
5	yüzüyor	banka	374	7		20	giyiyor	mezarlık	491	6
5	uçtu	havuz	404	7		20	alıştı	poligon	535	6
6	yakmıştı	orman	496	7		21	durmuştu	durak	490	8
6	basıyor	matba	492	7		21	oturuyor	kafe	544	8
6	vurdu	stad	432	7		21	yattı	otel	483	8
6	kuruyordu	balkon	493	7		21	uzanıyordu	sahil	606	8
6	bıkmıştı	ofis	494	7		21	bilmişti	okul	421	8
6	boyuyor	ev	435	7		21	koşuyor	spor salonu	365	8
6	pişti	mutfak	485	7		21	yürüdü	sokak	405	8
6	gömüyordu	mezarlık	438	7		21	okuyordu	kütüphane	548	8
6	giymişti	mağaza	492	7		21	yüzmüştü	havuz	471	8
6	alışıyor	iş yeri	541	7		21	uçuyor	havaalanı	503	8
6	durdu	bozkır	485	7		21	yaktı	deniz	533	8
6	oturuyordu	pazar	462	7		21	basıyordu	gökyüzü	506	8
6	yatmıştı	durak	410	7		21	vurmuştu	müze	429	8
6	uzanıyor	podyum	446	7		21	kuruyor	banka	458	8
6	bildi	kamp	445	7		21	bıktı	tarla	479	8
6	koşuyordu	kütüphane	527	7		21	boyuyordu	orman	466	8
6	yürümüştü	gökyüzü	484	7		21	pişmişti	podyum	549	8
6	okuyor	tarla	498	7		21	gömüyor	mağaza	503	8
6	yüzdü	banka	454	7		21	giydi	mezarlık	480	8
6	uçuyordu	havuz	494,5	7		21	alışıyordu	poligon	454	8
7	yakıyor	orman	431	6		22	duruyor	durak	507	9
7	bastı	matba	445	6		22	oturdu	kafe	536	9
7	vuruyordu	stad	390	6		22	yatıyordu	otel	496	9
7	kurumuştu	balkon	462	6		22	uzanmıştı	sahil	498	9
7	bıkıyor	ofis	449	6		22	biliyor	okul	469	9
7	boyadı	ev	413	6		22	koştu	spor salonu	649	9
7	pişiyordu	mutfak	515	6		22	yürüyordu	sokak	465	9
7	gömmüştü	mezarlık	435	6		22	okumuştu	kütüphane	625	9
7	giyiyor	mağaza	450	6		22	yüzüyor	havuz	473	9
7	alıştı	iş yeri	411	6		22	uçtu	havaalanı	587	9
7	duruyordu	bozkır	438	6		22	yakıyordu	deniz	487	9
7	oturmuştu	pazar	420	6		22	basmıştı	gökyüzü	413	9
7	yatıyor	durak	414	6		22	vuruyor	müze	496	9
7	uzandı	podyum	436	6		22	kurudu	banka	600	9
7	biliyordu	kamp	608	6		22	bıkıyordu	tarla	476	9
7	koşmuştu	kütüphane	505	6		22	boyamıştı	orman	474	9
7	yürüyor	gökyüzü	487	6		22	pişiyor	podyum	641	9
7	okudu	tarla	492	6		22	gömdü	mağaza	455	9
7	yüzüyordu	banka	427	6		22	giyiyordu	mezarlık	589	9
7	uçmuştu	havuz	416	6		22	alışmıştı	poligon	677	9
8	yaktı	orman	515,5	5		23	durdu	durak	497	7
8	basıyordu	matba	635	5		23	oturuyordu	kafe	407	7
8	vurmuştu	stad	490	5		23	yatmıştı	otel	448	7
8	kuruyor	balkon	522	5		23	uzanıyor	sahil	523	7
8	bıktı	ofis	518	5		23	bildi	okul	451	7
8	boyuyordu	ev	598	5		23	koşuyordu	spor salonu	667	7
8	pişmişti	mutfak	478	5		23	yürümüştü	sokak	570	7
8	gömüyor	mezarlık	524	5		23	okuyor	kütüphane	410	7
8	giydi	mağaza	513	5		23	yüzdü	havuz	484	7
8	alışıyordu	iş yeri	426	5		23	uçuyordu	havaalanı	541	7
8	durmuştu	bozkır	518	5		23	yakmıştı	deniz	447	7

Experiment Data (900 ms condition)									
Partic.	**Prime**	**Target**	**RT (ms)**	**BDS**		**Partic.**	**Prime**	**Target**	**RT (ms)**	**BDS**
8	oturuyor	pazar	534	5		23	basıyor	gökyüzü	497	7
8	yattı	durak	542	5		23	vurdu	müze	422	7
8	uzanıyordu	podyum	532	5		23	kuruyordu	banka	474	7
8	bilmişti	kamp	510	5		23	bıkmıştı	tarla	433	7
8	koşuyor	kütüphane	551	5		23	boyuyor	orman	430	7
8	yürüdü	gökyüzü	542	5		23	pişti	podyum	686	7
8	okuyordu	tarla	532	5		23	gömüyordu	mağaza	471	7
8	yüzmüştü	banka	561	5		23	giymişti	mezarlık	492	7
8	uçuyor	havuz	568	5		23	alışıyor	poligon	492	7
9	yakıyordu	orman	491	6		24	duruyordu	durak	485	6
9	basmıştı	matba	485	6		24	oturmuştu	kafe	614,5	6
9	vuruyor	stad	500	6		24	yatıyor	otel	511	6
9	kurudu	balkon	469	6		24	uzandı	sahil	549	6
9	bıkıyordu	ofis	448	6		24	biliyordu	okul	485	6
9	boyamıştı	ev	460	6		24	koşmuştu	spor salonu	608	6
9	pişiyor	mutfak	531	6		24	yürüyor	sokak	304	6
9	gömdü	mezarlık	470	6		24	okudu	kütüphane	703	6
9	giyiyordu	mağaza	463	6		24	yüzüyordu	havuz	485	6
9	alışmıştı	iş yeri	497	6		24	uçmuştu	havaalanı	621	6
9	duruyor	bozkır	510	6		24	yakıyor	deniz	567	6
9	oturdu	pazar	446	6		24	bastı	gökyüzü	570	6
9	yatıyordu	durak	472	6		24	vuruyordu	müze	638	6
9	uzanmıştı	podyum	451	6		24	kurumuştu	banka	572	6
9	biliyor	kamp	537	6		24	bıkıyor	tarla	585	6
9	koştu	kütüphane	443	6		24	boyadı	orman	568	6
9	yürüyordu	gökyüzü	486	6		24	pişiyordu	podyum	660	6
9	okumuştu	tarla	557	6		24	gömmüştü	mağaza	530	6
9	yüzüyor	banka	473	6		24	giyiyor	mezarlık	603	6
9	uçtu	havuz	497	6		24	alıştı	poligon	572	6
10	yakmıştı	orman	384	7		25	durmuştu	durak	658	9
10	basıyor	matba	438	7		25	oturuyor	kafe	444	9
10	vurdu	stad	358	7		25	yattı	otel	427	9
10	kuruyordu	balkon	422	7		25	uzanıyordu	sahil	420	9
10	bıkmıştı	ofis	406	7		25	bilmişti	okul	438	9
10	boyuyor	ev	412	7		25	koşuyor	spor salonu	665	9
10	pişti	mutfak	435	7		25	yürüdü	sokak	500	9
10	gömüyordu	mezarlık	423	7		25	okuyordu	kütüphane	436	9
10	giymişti	mağaza	415	7		25	yüzmüştü	havuz	497	9
10	alışıyor	iş yeri	435	7		25	uçuyor	havaalanı	538	9
10	durdu	bozkır	409	7		25	yaktı	deniz	456	9
10	oturuyordu	pazar	388	7		25	basıyordu	gökyüzü	474	9
10	yatmıştı	durak	432	7		25	vurmuştu	müze	537	9
10	uzanıyor	podyum	443	7		25	kuruyor	banka	556	9
10	bildi	kamp	390	7		25	bıktı	tarla	489	9
10	koşuyordu	kütüphane	400	7		25	boyuyordu	orman	443	9
10	yürümüştü	gökyüzü	383	7		25	pişmişti	podyum	514	9
10	okuyor	tarla	415	7		25	gömüyor	mağaza	501	9
10	yüzdü	banka	414	7		25	giydi	mezarlık	451	9
10	uçuyordu	havuz	422	7		25	alışıyordu	poligon	568	9
11	yakıyor	orman	478	6		26	duruyor	durak	485	9
11	bastı	matba	536	6		26	oturdu	kafe	396	9
11	vuruyordu	stad	451	6		26	yatıyordu	otel	276	9
11	kurumuştu	balkon	483	6		26	uzanmıştı	sahil	561	9

Experiment Data (900 ms condition)									
Partic.	**Prime**	**Target**	**RT (ms)**	**BDS**		**Partic.**	**Prime**	**Target**	**RT (ms)**	**BDS**
11	bıkıyor	ofis	471	6		26	biliyor	okul	324	9
11	boyadı	ev	425	6		26	koştu	spor salonu	501	9
11	pişiyordu	mutfak	519	6		26	yürüyordu	sokak	465	9
11	gömmüştü	mezarlık	515	6		26	okumuştu	kütüphane	265	9
11	giyiyor	mağaza	458	6		26	yüzüyor	havuz	404	9
11	alıştı	iş yeri	609	6		26	uçtu	havaalanı	494	9
11	duruyordu	bozkır	562	6		26	yakıyordu	deniz	448	9
11	oturmuştu	pazar	442	6		26	basmıştı	gökyüzü	441	9
11	yatıyor	durak	480	6		26	vuruyor	müze	464	9
11	uzandı	podyum	488	6		26	kurudu	banka	435	9
11	biliyordu	kamp	442	6		26	bıkıyordu	tarla	440	9
11	koşmuştu	kütüphane	547	6		26	boyamıştı	orman	356	9
11	yürüyor	gökyüzü	482	6		26	pişiyor	podyum	449	9
11	okudu	tarla	408	6		26	gömdü	mağaza	439	9
11	yüzüyordu	banka	469	6		26	giyiyordu	mezarlık	430	9
11	uçmuştu	havuz	446	6		26	alışmıştı	poligon	309	9
12	yaktı	orman	480	8		27	durdu	durak	466	8
12	basıyordu	matba	649	8		27	oturuyordu	kafe	447	8
12	vurmuştu	stad	618	8		27	yatmıştı	otel	458	8
12	kuruyor	balkon	473	8		27	uzanıyor	sahil	367	8
12	bıktı	ofis	799	8		27	bildi	okul	434	8
12	boyuyordu	ev	463	8		27	koşuyordu	spor salonu	411	8
12	pişmişti	mutfak	582	8		27	yürümüştü	sokak	428	8
12	gömüyor	mezarlık	717	8		27	okuyor	kütüphane	449	8
12	giydi	mağaza	436	8		27	yüzdü	havuz	420	8
12	alışıyordu	iş yeri	534	8		27	uçuyordu	havaalanı	565	8
12	durmuştu	bozkır	541	8		27	yakmıştı	deniz	424	8
12	oturuyor	pazar	540	8		27	basıyor	gökyüzü	466	8
12	yattı	durak	460	8		27	vurdu	müze	444	8
12	uzanıyordu	podyum	507	8		27	kuruyordu	banka	424	8
12	bilmişti	kamp	470	8		27	bıkmıştı	tarla	400	8
12	koşuyor	kütüphane	440	8		27	boyuyor	orman	450	8
12	yürüdü	gökyüzü	464	8		27	pişti	podyum	483	8
12	okuyordu	tarla	448	8		27	gömüyordu	mağaza	449	8
12	yüzmüştü	banka	459	8		27	giymişti	mezarlık	450	8
12	uçuyor	havuz	838	8		27	alışıyor	poligon	453	8
13	yakıyordu	orman	638	6		28	duruyordu	durak	489	8
13	basmıştı	matba	744	6		28	oturmuştu	kafe	520	8
13	vuruyor	stad	679	6		28	yatıyor	otel	491	8
13	kurudu	balkon	654	6		28	uzandı	sahil	445	8
13	bıkıyordu	ofis	476	6		28	biliyordu	okul	412	8
13	boyamıştı	ev	637	6		28	koşmuştu	spor salonu	563	8
13	pişiyor	mutfak	566	6		28	yürüyor	sokak	421	8
13	gömdü	mezarlık	607	6		28	okudu	kütüphane	377	8
13	giyiyordu	mağaza	621	6		28	yüzüyordu	havuz	441	8
13	alışmıştı	iş yeri	675	6		28	uçmuştu	havaalanı	522	8
13	duruyor	bozkır	611	6		28	yakıyor	deniz	530	8
13	oturdu	pazar	595	6		28	bastı	gökyüzü	470	8
13	yatıyordu	durak	569	6		28	vuruyordu	müze	527	8
13	uzanmıştı	podyum	626	6		28	kurumuştu	banka	536	8
13	biliyor	kamp	577	6		28	bıkıyor	tarla	490	8
13	koştu	kütüphane	547	6		28	boyadı	orman	466	8
13	yürüyordu	gökyüzü	657	6		28	pişiyordu	podyum	583	8

Experiment Data (900 ms condition)									
Partic.	**Prime**	**Target**	**RT (ms)**	**BDS**		**Partic.**	**Prime**	**Target**	**RT (ms)**	**BDS**
13	okumuştu	tarla	636	6		28	gömmüştü	mağaza	565	8
13	yüzüyor	banka	631	6		28	giyiyor	mezarlık	519	8
13	uçtu	havuz	486	6		28	alıştı	poligon	497	8
14	yakmıştı	orman	461	7		29	durmuştu	durak	441	8
14	basıyor	matba	448	7		29	oturuyor	kafe	409	8
14	vurdu	stad	444	7		29	yattı	otel	398	8
14	kuruyordu	balkon	473	7		29	uzanıyordu	sahil	462	8
14	bıkmıştı	ofis	523	7		29	bilmişti	okul	346	8
14	boyuyor	ev	489	7		29	koşuyor	spor salonu	542	8
14	pişti	mutfak	467	7		29	yürüdü	sokak	401	8
14	gömüyordu	mezarlık	424	7		29	okuyordu	kütüphane	392	8
14	giymişti	mağaza	502	7		29	yüzmüştü	havuz	447	8
14	alışıyor	iş yeri	500	7		29	uçuyor	havaalanı	620	8
14	durdu	bozkır	424	7		29	yaktı	deniz	413	8
14	oturuyordu	pazar	434	7		29	basıyordu	gökyüzü	459	8
14	yatmıştı	durak	434	7		29	vurmuştu	müze	479	8
14	uzanıyor	podyum	432	7		29	kuruyor	banka	438	8
14	bildi	kamp	429	7		29	bıktı	tarla	415	8
14	koşuyordu	kütüphane	450	7		29	boyuyordu	orman	294	8
14	yürümüştü	gökyüzü	432	7		29	pişmişti	podyum	447	8
14	okuyor	tarla	498	7		29	gömüyor	mağaza	450	8
14	yüzdü	banka	498	7		29	giydi	mezarlık	500	8
14	uçuyordu	havuz	467	7		29	alışıyordu	poligon	524	8
15	yakıyor	orman	491	7		30	duruyor	durak	406	8
15	bastı	matba	554	7		30	oturdu	kafe	394	8
15	vuruyordu	stad	484	7		30	yatıyordu	otel	417	8
15	kurumuştu	balkon	496	7		30	uzanmıştı	sahil	413	8
15	bıkıyor	ofis	736	7		30	biliyor	okul	393	8
15	boyadı	ev	478	7		30	koştu	spor salonu	462	8
15	pişiyordu	mutfak	548	7		30	yürüyordu	sokak	417	8
15	gömmüştü	mezarlık	557	7		30	okumuştu	kütüphane	450	8
15	giyiyor	mağaza	536	7		30	yüzüyor	havuz	389	8
15	alıştı	iş yeri	535	7		30	uçtu	havaalanı	424	8
15	duruyordu	bozkır	355	7		30	yakıyordu	deniz	415	8
15	oturmuştu	pazar	469	7		30	basmıştı	gökyüzü	468	8
15	yatıyor	durak	520	7		30	vuruyor	müze	454	8
15	uzandı	podyum	516	7		30	kurudu	banka	441	8
15	biliyordu	kamp	502	7		30	bıkıyordu	tarla	522	8
15	koşmuştu	kütüphane	628	7		30	boyamıştı	orman	407	8
15	yürüyor	gökyüzü	511	7		30	pişiyor	podyum	442	8
15	okudu	tarla	526	7		30	gömdü	mağaza	418	8
15	yüzüyordu	banka	525	7		30	giyiyordu	mezarlık	501	8
15	uçmuştu	havuz	520	7		30	alışmıştı	poligon	468	8