Chapter 2
The Role of Context on Age of Acquisition Effect:
Strategic Control in Word Naming in Turkish

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ABSTRACT

Processes involved in converting print to sound are reported to be flexible and under the strategic control of skilled readers even in transparent orthographies. In this respect, word frequency effect, regularity, and lexicality have been the topic of much research and debate in understanding how context is involved in the emergence of strategies. However, whether age of acquisition (AoA) effects are influenced by context and under the strategic control of readers have yet to be established. A series of single-word naming experiments addresses this issue and examines the role of filler type critically manipulated on lexicality, frequency, and imageability on the size of AoA effect in word naming in an entirely transparent orthography. Overall, results, which are discussed within the current theoretical frameworks, suggest that context plays a significant role on AoA.

INTRODUCTION

It has long been acknowledged that readers can attune their reading strategies in response to task demands as determined by context (e.g. Frederiksen & Kroll, 1976; Baluch & Besner, 1991; Paap & Noel, 1991; Rastle & Coltheart, 1999). An example

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of this flexibility in selecting the most effective strategy is observed when the effect of word frequency is eliminated when subjects name words and nonwords mixed together in a single block. Historically, this phenomenon reported in English and other orthographies had been explained within the dual-route model of reading (e.g., Baluch & Besner, 1991; Coltheart & Rastle, 1994; Monsell, Patterson, Graham, Hughes, & Milroy, 1992; Raman, Baluch & Sneddon, 1996; Rastle & Coltheart, 1999; Reynolds & Besner, 2005; Tabossi & Laghi, 1992; Zevin & Balota, 2000). According to the dual-route model generation of phonology can take place via two qualitatively distinct routes: namely the lexical and the nonlexical route (e.g. Coltheart, 1978; Coltheart and colleagues, 1993; 1999). What characterizes these two routes is that while the nonlexical phonology can be 'assembled' via rules, assumptions about generating phonology via the lexical route is twofold: One way to generate lexical phonology is assumed to be via the direct orthography-to-phonology, OP, route where words' phonology is directly 'addressed'. A second way of generating lexical phonology is assumed to be via the orthography-to-semantics route where a word's meaning is activated for the purpose of generating phonology. Some dual-route theorists have argued that the dual-route model is in effect a three-route model, whilst, it is generally assumed that the impact of the semantic route on single-word naming in skilled reading is minimal (e.g. Besner, 1999; Besner & Smith, 1992). This is because the general consensus within the dual-route framework (in terms of RTs) is that attaining phonology from print via the semantic route is the slowest of the two routes. It is further assumed that the involvement of the semantic route in computing words' phonology is only facilitated when words' semantic characteristics such as imageability is involved. However, it must be highlighted that systematic investigation of imageability effects in single-word naming is not a widely explored issue in English with the exception of several papers (Strain, Patterson, & Seidenberg, 1995; Hino & Lupker, 1996) and to date just a handful of papers have been reported on other writing systems, e.g. Persian (Baluch & Besner, 2001) and Turkish (Raman & Baluch, 2001). In summary, semantics is assumed to contribute to the computation of phonology from print in orthographies with inconsistent and/or irregular OP representations, such as English and opaque Persian, but not in orthographies with entirely consistent OP representations such as Turkish. It would be naïve to assume that there is no semantic involvement in reading entirely transparent orthographies as semantic information ought to be utilized in order to extract meaning during reading. When OP mappings are entirely transparent, however, the input from semantics in decoding OP mappings that are exception to the rule becomes redundant. Therefore, the claim here is that semantics develops and exerts itself differentially as a function of orthographic transparency across different languages. Indeed, evidence for this claim was presented in Turkish (Raman & Baluch, 2001) and Persian (Baluch & Besner, 2001).

Insofar as strategies are considered, although several positions (e.g. attentional control, de-emphasis of routes) have been proposed to explain the phenomenon of how presenting identical target stimuli in different contexts, i.e. mixed vs pure blocks, has differential influence on RTs and accuracy, the time criterion is the most plausible alternative account thus far (Lupker, Brown & Colombo, 1997; Kinoshita & Lupker 2002; 2007). The proposition is that a time-criterion which is determined by the perceived difficulty of the stimuli to be named is active prior to computing a phonological output. The notion of difficulty is central to time-criterion because it leads to strategically adjusting the generation of an acceptable criterion appropriate for all stimuli to be named which in effect leads to the homogenisation of RTs. Previous work in Turkish explored the role of nonword fillers on word frequency in which single-word naming in Turkish was strongly influenced by the setting of a time-criterion in response to presence of nonwords that lent support to the time-criterion account (Raman, Baluch & Besner, 2004). While the time-criterion account is mute with respect to the issue of the nature of OP representations, the number of routes and which route drives the computation of phonology, one of it's most prominent feature is that readers employ a checking strategy especially under 'slow' conditions such as the irregular English words when computing phonology. This strategy is to ensure that a corresponding phonological code exists in the phonological output lexicon prior to attempting articulation, hence maximising a successful outcome. It is not yet established whether a checking mechanism can be extended to totally transparent orthographies in which OP mappings are one-to-one with very low error rates in pronunciation in which such a mechanism would redeem futile. Equally, it could be argued that the checking mechanism may evolve as an artefact of the writing system.

Traditionally, research on examining strategies in word naming has primarily focused on the influence of context on word frequency and regularity effects, and lexicality, i.e. the use of nonwords (e.g., Baluch & Besner, 1991, Kinoshita & Lupker, 2002; 2007, Lupker, et al, 1997; Raman et al, 1996, Raman et al, 2004, Reynolds & Besner, 2005 amongst others). It is of importance, therefore, to explore whether context will differentially influence and modify another lexical variable that has attracted much research, namely AoA. According to Johnston and Barry (2006) 'AoA effects .. have also been claimed to operate either instead of, or over and above, those of word frequency.'. Understanding the conditions that facilitate or hinder the AoA effects in word naming will be a key addition to the growing body of literature on strategies.

It is widely accepted that the age at which particular words enter into our vocabulary has a long-lasting effect such that early acquired words have been consistently demonstrated to possess an advantage over words that are acquired comparably later on in life (see Juhasz, 2005, and Johnston & Barry, 2006 for

comprehensive reviews). This advantage known as the AoA effect has an impact on lexical processing, picture naming and face recognition amongst other tasks. More importantly, AoA is now agreed to be a universal phenomenon in lexical processing irrespective of the linguistic properties of a given language. To date reports exist in alphabetic languages such as English (e.g., Gerhand & Barry, 1999; Morrison & Ellis, 1999; and Morrison & Ellis, 2000; Morrison, Hirsh, Chappell & Ellis, 2002), Spanish (e.g., Cuetos, Ellis & Alvarez, 1999), French (Bonin and colleagues, 2001; 2002), Italian (Barca, Burani & Arduino, 2002; Bates, Burani, D'Amico & Barca, 2001), Greek (e.g., Bogka, Masterson, Druks, Fragkioudaki, Chatziprokopiou & Economou, 2003), Dutch (e.g., Ghyselinck, Custers & Brysbaert, 2004), Turkish (Raman, 2006), German (Brase & Raman, 2009) and non-alphabetic languages such as Japanese (Havelka & Tomita, 2006; and Yamazaki, Ellis, Morrison & Lambon Ralph, 1997) and Chinese (Chen and colleagues, 2007a, 2007b).

The arbitrary mapping hypothesis (Ellis & Lambon Ralph, 2000; Monaghan & Ellis, 2002a; 2002b) and the semantic hypothesis (Brysbaert, Lange & Van Wijnendaele, 2000; Brysbaert, van Wijnendaele & De Deyne, 2000) are two main theoretical views that explain the locus of AoA effects in lexical processing. Whilst OP mappings are central to understanding the AoA effects in the former account, semantics is at centre of the latter view. Therefore, OP mappings together with semantics play a central role in understanding the AoA effects particularly as a function of orthographic transparency. If one assumes that AoA (and imageability) arise at the level of arbitrary mappings and/or semantics then we would not expect reliable effects in writing systems in which OP mappings are totally predictable and one-to-one. This premise is partially supported in that no reliable imageability effects were found in Turkish (Raman & Baluch, 2001) or in transparent Persian (Baluch & Besner, 2001) whilst a robust AoA effect in word naming was reported in Turkish (Raman, 2006). Collectively the findings suggest that in extremely transparent orthographies a) the contribution of semantics is minimal insofar as computation of phonology is concerned (but see point above in the role of semantics in extracting meaning), and b) a reliable AoA effect is perhaps indicative of a lexical locus for AoA, similar to word frequency. Consequently, since reports of AoA effects are so ubiquitous AoA must be a universal and an inherent property of the cognitive architecture (Raman, 2006).

The aim of the series of experiments reported here is twofold: a) first, the aim is to explore the impact of context on AoA to test the claims of the time-criterion account - a limitation in the current literature - in an entirely transparent orthography and b) second, to examine the issue of strategic control in word naming in relation to AoA. If the time-criterion account holds true, then the AoA effect is predicted to vary and to be modified in response to the ease/difficulty of the filler stimuli. More specifically, a significant AoA effect is expected to be maintained when Early and

Late items are presented on their own in Experiments 1 and 6 as well as with High frequency and High imageable filler items in Experiments 2 and 7, respectively. Moreover, AoA effect should be reduced considerably when Early and Late items are presented with nonwords, in Experiments 5 and 10 as well as when presented with Low frequency and Low imageable items in Experiments 4 and 9. The effect of Mid frequency and Mid imageable filler items is expected to considerably reduce the AoA effect.

GENERAL METHOD

Participants

Participation in all experiments was on a voluntary basis from native Turkish speaking undergraduate students at the Eastern Mediterranean University, Cyprus. Each experiment employed a different set of participants who did not take part in any other experiment. Participants were given course accreditation in return of their participation.

Apparatus and Procedure

Participants were instructed to call out each word presented on the computer screen as fast and as accurately as possible. The stimuli were presented one at a time using Superlab experimental software. Each word appeared in the centre of an Acer notepad screen in Times New Roman, black 32-point lowercase font. All test items were mixed at random and presented in two blocks. A block of practice trials with 10 words were presented for naming prior to the main experiment. This allowed the participants to familiarise themselves with the experimental procedure and for the voice key to be adjusted accordingly. Order of presentation for each block of stimuli was counterbalanced for participants. Reaction times were recorded via a voice activated microphone. A 1000ms inter-stimulus interval was followed by the target word which remained on the screen until it was named. Errors were noted by the experimenter.

Materials

The target and filler stimuli used in the experiments came from previously established norms for AoA, imageability and frequency in Turkish (Raman, 2001; 2004; 2006). Word frequency, imageability and AoA counts were obtained for 433 words based on subjective ratings from 50 highly literate, native speakers of Turkish. Frequency

norms were obtained by asking participants to indicate the frequency with which they encountered a word on a 7-point rating scale ranging from 1 (most frequent) to 7 (least frequent). Subjective ratings thought to be closely linked with objective norms (Gernsbacher, 1984; Gordon, 1985) were used for frequency, AoA and imageability in the absence of objective word norms in Turkish. Word imageability was also rated on a 7-point scale ranging from 7 (very high imageability) to 1 (no imageability). Word imageability norms in Turkish was previously demonstrated to be reliably correlated with ($r = 0.8$) with those obtained by Paivio, Yuille and Madigan (1968) in English (see Raman & Baluch, 2001 for details). For example, a high imageable word such as ANNE (*mother*) has a rating of 6.3 in Turkish and a corresponding rating of 6.7 in Paivio et. al.'s scale. Similarly, a low imageable word such as FELEK (*fate*) has a rating of 1.98 in Turkish and 2.3 in English.

The instructions for AoA ratings were adapted from Gilhooly and Logie (1980) in that participants were required to estimate the age they encountered a word for the first time in their language environment - either in spoken or written form. The scale on which they had to indicate the acquisition age ranged from 1 to 7, where 1 = 0-2 years old, 2 = 3-4 years old, 3 = 4-5 years old, 4 = 5-6 years old, 5 = 7-9 years old, 6 = 10-11 years old and 7 = 12 years old or older. For the purpose of the study, a word was selected as being acquired early if it had a mean rating of 2.5 (up to 4yrs of age) or less, and late if it had a mean rating of 6 (over 10yrs of age) or above.

Two target word sets, Early AoA and Late AoA, each with 25 items were created. All words in each of the two sets were high frequency, high Imageable and were matched on initial phoneme, letter and syllable length. The critical variable was AoA with an early acquired word such as GÜNEŞ (*sun*) matched with a late acquired word GÜMÜŞ (*silver)*. Early AoA and Late AoA Turkish words and their English equivalents are presented with their corresponding AoA, imageability and frequency ratings in the Appendix. The norms for English translations were obtained from the electronic MRC Psycholinguistic Database.

The filler items were matched to the target stimuli on as many variables particularly on number of letters and initial phoneme as best as possible. In addition, care was taken to match the filler items in Study 1 (High, Mid, and Low Frequency conditions) with Study 2 (High, Mid, and Low Imageable conditions) on AoA, Imageability, Frequency and Letter length in an attempt to control for as many extraneous variables as possible. Summary statistics for Target and Filler items are presented in Table 1. Full details of the filler items including the nonwords used in Experiments 5 and 10 are presented in the Appendix.

Table 1. Summary statistics (Mean and SD) of target and filler items AoA, imageability and frequency ratings together with letter and syllable length

	Target Stimuli		**Filler Items Study 1**			**Filler Items Study 2**		
	Early AoA	Late AoA	HF Exp 2	MF Exp 3	LF Exp 4	HI Exp 7	MI Exp 8	LI Exp 9
AoA	1.89 (.31)	4.54 (.64)	3.34 (.82)	4.89 (.91)	4.97 (.64)	3.47 (.86)	4.64 (.87)	4.98 (.65)
Imageability	5.33 (.32)	5.03 (.30)	4.94 (.34)	4.56 (.28)	3.33 (.84)	5.02 (.51)	4.78 (.23)	2.78 (.60)
Frequency	1.78 (.46)	1.96 (.36)	1.77 (.20)	3.78 (.18)	4.63 (.48)	1.93 (.62)	3.05 (.82)	4.01 (1.44)
Letter Length	4.04 (1.17)	4.44 (1.39)	4.54 (.86)	5.62 (1.59)	5.10 (1.17)	5.04 (1.01)	4.98 (1.08)	5.24 (1.08)
Syllable Length	1.76 (.44)	1.76 (.60)	1.84 (.37)	2.24 (.66)	2.08 (.44)	2.02 (.32)	2.02 (.38)	2.18 (.56)

Study 1

Study 1 comprised five single-word naming experiments all utilising the target items (25 Early and 25 Late acquired words) in the presence of filler items manipulated on frequency (high, mid, low) and lexicality (nonwords).

Experiment 1

In a single-word naming task, 33 participants were required to call out 25 early and 25 late acquired target items only. The mean RTs for early acquired words was 519ms compared to 550ms for late acquired words and a planned comparison showed that this difference (31ms) was statistically significant [$t(32)=4.04$ $p<0.0001$]. This finding is in line with earlier reports of a reliable AoA effect in Turkish.

Experiment 2

The results of Experiment 1 re-establish that early acquired words are named significantly faster than late acquired words in Turkish. The aim of Experiment 2 is to examine the impact of filler stimuli, namely High frequency words, on the AoA effect. A different group of 34 participants were asked to read aloud the target items together with 50 High frequency filler words. If reading is under the strategic control of readers as previously reported in Raman et al (2004) we predict that according to the time-criterion account, the AoA effect should prevail because

High-frequency filler items are 'easy' items to name. Due to the large proportion (75%) of fast items comprised of Early items (25%) together with High frequency filler items (50%) in the naming task, all RTs irrespective of AoA should be speeded up if homogenisation of RTs occur.

The mean RTs for early acquired items was 499ms and 517ms for late acquired items yielding a difference of 18ms between the two conditions that was significant [$t(33)=4.05$ $p<0.0001$]. Noteworthy is that as predicted both mean RTs for early and late acquired words are faster than in Experiment 1.

Experiment 3

It is clear from the results in Experiment 2 that when a large proportion of stimuli in the naming list are 'easy/fast', the RTs for the target stimuli are speeded up. Employing 36 participants, Experiment 3 investigates the role of 50 mid-frequency filler items, presumably 'slower' items than high-frequency words, on AoA. Again, if participants modify their RTs in response to the naming list, which is comprised of fast Early items (25%), slow Late items (25%) and mid-speed Mid frequency fillers (50%) one would predict overall RTs to slow down and the AoA to be reduced as a result as homogenisation occurs.

A 15ms difference found between the mean RTs of early acquired words (516ms) and late acquired words (531ms) was significant in the planned comparison [$t(35)=2.3$ $p<0.03$]. It is important to note however that there is a considerable overall slowing down of the RTs compared to Experiment 2.

Experiment 4

As can be seen in Experiment 3, the RTs for each condition have slowed down whereby a significant AoA has been maintained. The aim of Experiment 4 is to investigate the impact of 50 low-frequency items on AoA. Participants were 36 undergraduates. It is predicted that AoA will be eliminated or largely reduced to reflect the influence of a large proportion (75%) of slow items made up of Late items (25%) and Low frequency filler items (50%) on the homogenisation of RTs in the list compared to 25% fast Early items if readers adjust their naming in response to the naming list.

The mean RTs for early acquired words is 524ms and for late acquired words 529ms. The difference of 5ms is non-significant [$t(35)=1.8$ $p>0.05$] in the planned comparison. This finding is in line with the predictions of the time-criterion account.

Experiment 5

The findings from Experiment 4 clearly demonstrate that RTs are slowed down in response to low-frequency filler words such that the AoA effect is eliminated. It is of interest to turn to Experiment 5 in which filler items are matched nonwords, or 'very slow' items. In line with the time criterion account, the outcome is expected to be similar to Experiment 4 will a null effect for AoA as 75% of items are slow compared with 25% that are fast. Thirty-six undergraduate students took part in this task.

The mean RTs for early acquired words was 534ms versus 539ms for late acquired words. The difference between the two conditions (5ms) was non-significant [$t(35)=1.7$ $p>0.05$]. Moreover, in line with previous reports in Turkish a reliable lexicality effect, i.e., the faster naming of words compared to matched nonwords, was observed.

A summary of the results of Study 1 across five experiments can be seen in Table 2. Data from Experiments 2-4 were subjected to a 2 (AoA: Early vs Late) x 3 (Filler type: High, Mid, Low Frequency) factorial ANOVA which demonstrated a main effect for Filler type, $F(2,144)=3.5$ $p<0.03$ and a marginal main effect for AoA, $F(1, 144)=3.77$ $p<0.05$ and no interaction. The gradual elimination of the AoA effect when Early and Late items were presented within an increasingly slower and more difficult context from Experiment 1 to Experiment 5 lends further support

Table 2. Summary results for experiments 1-5 in study 1. Mean RTs in milliseconds and standard deviations (SD in brackets) for early and late acquired words (EA and LA) and frequency filler stimuli; Difference in mean AoA RTs and statistical test

	EA Mean, SD	**LA Mean, SD**	**Filler Item Mean, SD**	**Difference Between Early and Late; and Statistical Test (EA vs LA)**
Exp1 (N=33) Target words	519 (33)	550 (30)	NA	31ms $t(32)=4.04$ $p<0.0001$
Exp2 (N=34) Target words + High Frequency fillers	499 (26)	517 (31)	501 (35)	18ms $t(33)=4.05$ $p<0.0001$
Exp3 (N= 36) Target words + Mid Frequency fillers	516 (38)	531 (42)	546 (30)	15ms $t(35)=2.3$ $p<0.03$
Exp4 (N=36) Target words + Low Frequency fillers	524 (35)	529 (31)	571 (26)	5ms $t(35)=1.8$ $p>0.05$ ns
Exp5 (N=36) Target words + Nonword fillers	534 (29)	539 (33)	587 (76)	5ms $t(35)=1.7$ $p>0.05$ ns

to the flexibility with which readers generate phonology from print. The findings are in line with the predictions of the time-criterion account and demonstrate the homogenisation of RTs even in an entirely transparent orthography. Noteworthy is that the overall error rates were typically less than 1% therefore excluded in the Table and were not subjected to formal analyses.

Study 2

A subsequent set of five experiments were designed similar to those in Study 1 and the Method, Apparatus and Procedure were the same as before. The major difference was that the filler items were manipulated on word imageability instead of frequency. The rationale for manipulating word imageability as contextual background is motivated by the fact that it is a semantic variable and qualitatively different to word frequency. As discussed previously, the role of imageability in word naming appears to be unique to irregular or opaque orthographies such as English and Persian.

Predictions in Study 2 are similar to those in Study 1 where the AoA effect is predicted to be influenced and finally eliminated with increasing difficulty of the filler items. Two of the experiments in Study 2, namely Experiments 6 and 10, were identical to Experiments 1 and 5 in Study 1, and were conducted to affirm the reliability of the earlier findings. The previous findings in Experiment 1 were indeed confirmed in Experiment 6, with a 35ms difference that was significant for target items only, i.e. Early and Late items, [$t(29)=2.88$ $p<0.007$]. In Experiment 10, a 5ms difference that was nonsignificant [$t(29)=0.89$ $p>0.05$] for target items in the presence of matched nonwords also confirmed the results of Experiment 5 and the predictions of the time-criterion hypothesis. Again a lexicality effect was observed. In Experiments 7-9, participants named the target items when filler items were critically manipulated on imageability (High, Mid, Low).

Experiment 7

Participants (N=30) were asked to name the target stimuli together with 50 high-imageable filler words. It is expected that while the AoA effect persists, homogenisation of RTs should favour the speeding up of both Early and Late items if the effect of high imageable filler items is similar to the one observed for High frequency fillers in Experiment 2. This is because 75% (Early + High imageable) of the items in the naming list are fast compared to 25% which are slow (Late).

A statistically significant 26ms difference between Early (482ms) and Late (508ms) items is found [$t(29)=4.11$ $p<0.0001$]. This finding replicates the results of Experiment 2 indicating that AoA effects are maintained when target items are mixed with fast filler items.

Experiment 8

In this experiment, 30 participants named the target words presented with 50 medium-imageable words. As in Experiment 3, 25% of stimuli were fast, 25% were slow while 50% were mid-speed. It is expected that the RTs will be overall slower with a reduction in the AoA effect. Early items were 21ms faster in comparison to late items (508ms and 529ms respectively) that was reliable [$t(29)=1.94$ $p<0.06$]. It is important to note that although RTs have slowed down for both Early and Late items as predicted, the AoA effect is larger than in Experiment 3 (15ms difference).

Experiment 9

In this experiment, participants (N=30) called out the target words mixed with 50 low-imageable filler items. Early items were 9ms faster in comparison to late items (517ms and 526ms respectively) that is not significant [$t(29)=1.40$ $p>0.05$] as predicted.

A summary of the results of Study 2 across five experiments can be seen in Table 3. RTs from Experiments 7-9 were subjected to a 2 (AoA: Early, Late) x 3 (Filler type: High, Mid, Low Imageable) factorial ANOVA which showed a main effect for Filler type, $F(2, 144)=4.06$ $p<0.01$, and AoA, $F(1,144)=4.67$ $p<0.03$ and no significant interaction between the two variables. Error rates were less than 1% and were not subjected to formal analyses.

Table 3. Summary results for experiments 6-10 in study 2. Mean RTs in milliseconds and Standard Deviations (SD in brackets) for Early and Late Acquired words (EA and LA) and filler stimuli; Difference in mean AoA RTs and statistical test

	EA Mean, SD	**LA Mean, SD**	**Filler Item Mean, SD**	**Difference Between Early and Late; and Statistical Test (EA vs LA)**
Exp6 (N=30) Target words	504 (76)	539 (58)	NA	35ms $t(29)=2.88$ $p<0.007$
Exp7 (N=30) Target words + High Imageable fillers	482 (45)	508 (55)	496 (39)	26ms $t(29)=4.11$ $p<0.0001$
Exp8 (N=30) Target words + Mid Imageable fillers	508 (64)	529 (67)	520 (65)	21ms $t(29)=1.94$ $p<0.06$
Exp9 (N= 30) Target words + Low Imageable fillers	517 (75)	526 (73)	537 (63)	9ms $t(29)=1.47$ $p>0.05$ ns
Exp10 (N=30) Target words + Nonword fillers	526 (41)	531 (25)	575 (54)	5ms $t(29)=0.89$ $p>0.05$ ns

In order to evaluate the impact of filler word type on AoA, data from Experiments 2-4 and 7-9 were combined in a 2 (Filler word type: Frequency, Imageability) x 2 (AoA: Early, Late) factorial ANOVA which showed a significant main effect for AoA [$F(1, 296)=8.12$ $p<0.01$]. No significant main effect for filler word type [$F(1,296)=2.28$ $p>0.05$] or interaction between AoA and filler word type [$F(1,296)= 0.27$ $p>0.05$] was found. These results statistically firmly establish that the modifications in the AoA effect observed for Experiments 2-4 and 7-9 were a direct result of the filler stimuli, i.e. context, not due to the interaction between word frequency, imageability and AoA.

GENERAL DISCUSSION

The current studies sought to experimentally investigate the extent to which AoA effects in word naming can be modified by context in a series of naming experiments by putting the claims of the time-criterion account to the test. The results clearly demonstrate that naming RTs of target words, i.e., Early and Late acquired words, are differentially modified in response to filler items in the naming list. In brief, when filler items are either high frequency or high imageable words, the AoA effect is maintained and when filler items are low frequency or low imageable or nonwords, the AoA effect is eradicated. In the first instance, the findings are in line with the suppositions of the time criterion account which has been tested mainly on word frequency and regularity effects in previous studies (Lupker et al, 1997; Raman et al, 2004; Kinoshita & Lupker, 2002; 2007).

The findings from the current study are important on several accounts: First, they firmly establish the fact that the magnitude of the AoA effect is modified according to the filler words' frequency *and* imageability to the same extent in a transparent orthography. Second, the time criterion account of setting deadlines in response to all stimuli to be named in a naming list holds true for a novel psycholinguistic variable, AoA. In this context, the supposition of the time criterion that readers utilise a global checking mechanism prior to reading aloud in response to the task at hand is verified irrespective of the nature of the reading list (e.g. Chateau & Lupker, 2003; Kinoshita & Lupker, 2002; 2007; Raman et al, 2004). The results of Study 1 and Study 2 are in line with those reported earlier for Turkish (Raman et al., 2004) in which it was demonstrated that contrary to previous findings in the literature, word frequency effect was maintained in the presence of 'easy' nonwords whilst a null effect was found in the presence of 'difficult' nonwords. This further suggests to us that despite the extreme OP transparency readers of transparent orthographies also develop strategies in visual word recognition tasks which is modified accordingly in response to task demands and that this is a universal process.

Because imageability is thought to be a central variable in the semantic system and because the semantic system is thought to contribute to word naming and lexical decision (e.g., Baluch & Besner, 2001; Strain et al., 1995; Zevin & Seidenberg, 2002), its orthogonal impact on AoA reported here is remarkable. This is taken to support previous research in Dutch and English which AoA and imageability are manipulated orthogonally with a null effect for imageability and a reliable AoA effect under controlled conditions (e.g., Brysbaert et al., 2000a, 2000b; Morrison & Ellis, 2000).

Locating the origin of AoA effects has proved to be one of the major theoretical challenges for AoA researchers in the past four decades. This is partly because of the methodological shortcomings of earlier investigations that primarily utilised regression analyses which led to the portrayal of AoA as an artifactual variable that was derived from a combination of sources. In this respect, the locus of the AoA effect was initially thought to be either in the phonological output lexicon or in the mappings between the semantics and the lexical output phonology (e.g., Barry, Hirsch, Johnston & Williams, 2001; Brown & Watson, 1987; Gerhand & Barry, 1999; Morrison & Ellis, 1999). In view of contradictory evidence where reliable AoA effects were reported for tasks that do not require phonological processing (e.g. Brysbaert et al., 2000b; Yamazaki et al., 1997) there has been a shift towards a phonological input rather than a phonological output position in understanding the locus of AoA.

To summarise, the magnitude of the AoA effect in the ten experiments reported here appears to be dependent on the difficulty of the next item in the naming list. The easier the next item (as in Experiments 1, 2, 6 and 7) the larger the AoA effect. One could speculate further by assuming that the linguistic peculiarities of deep orthographies with less predictable OP mappings such as English may stipulate that readers attend to a particular strategy (i.e. lexical or nonlexical) that provides the most efficient and successful phonology early on in the process. Because an extremely transparent orthography such as Turkish is devoid of such linguistic dichotomies, it was previously suggested that the impact of the difficulty of the filler stimuli takes its toll later on in the process of deriving phonology, just prior to articulation (Raman et al., 2004). Based on the evidence reported here, the contribution from the semantic and lexical routes appear to contribute equally to the attuning of the AoA effect when filler items are manipulated on imageability and frequency, respectively. This in line with our earlier speculation that perhaps the contribution from the two routes are more harmonious than in a less transparent orthography since there is never a conflicting OP outcome. It is of interest to pursue the contribution from each route in English and other opaque orthography under similar filler conditions. One could speculate the magnitude of the AoA effect to be larger for example in Experiment 4 under the low frequency filler condition

as opposed to the low imageability filler condition in Experiment 9 because it is plausible to expect readers of opaque orthographies to utilise a semantic strategy to compute phonology under more 'difficult' reading conditions.

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REFERENCES

Baluch, B., & Besner, D. (1991). Visual word recognition: Evidence for strategic control of lexical and nonlexical routines in oral reading. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *17*(4), 644–652. doi:10.1037/0278-7393.17.4.644

Baluch, B., & Besner, D. (2001). Basic processes in reading: Semantics affects speeded naming of high-frequency words in an alphabetic script. *Canadian Journal of Experimental Psychology*, *55*(1), 63–69. doi:10.1037/h0087353 PMID:11301729

Barca, L., Burani, C., & Arduino, L. S. (2002). Word naming times and psycholinguistic norms for Italian nouns. *Behavior Research Methods, Instruments, & Computers*, *34*(3), 424–434. doi:10.3758/BF03195471 PMID:12395559

Barry, C., Hirsch, K. W., Johnston, R. A., & Williams, C. L. (2001). Age of acquisition, word frequency, and the locus of repetition priming of picture naming. *Journal of Memory and Language*, *44*(3), 350–375. doi:10.1006/jmla.2000.2743

Bates, E., Burani, C., D'Amico, S., & Barca, L. (2001). Word reading and picture naming in Italian. *Memory & Cognition*, *29*(7), 986–999. doi:10.3758/BF03195761 PMID:11820758

Besner, D. (1999). Basic processes in reading: Multiple routines in localist and connectionist models. In P. A. McMullen & R. M. Klein (Eds.), *Converging methods for understanding reading and dyslexia*. Cambridge, MA: MIT Press.

Besner, D., & Smith, M. C. (1992). Basic Processes in reading: Is the orthographic depth hypothesis sinking? In R. Frost & L. Katz (Eds.), *Advances in psychology: orthography, phonology, morphology and meaning*. North-Holland. doi:10.1016/S0166-4115(08)62788-0

Bogka, N., Masterson, J., Druks, J., Fragkioudaki, M., Chatziprokopiou, E. S., & Economou, K. (2003). Object and action picture naming in English and Greek. *The European Journal of Cognitive Psychology*, *15*(3), 371–403. doi:10.1080/09541440303607

Bonin, P., Chalard, M., Meot, A., & Fayol, M. (2002). The determinants of spoken and written picture naming latencies. *British Journal of Psychology*, *93*(1), 89–114. doi:10.1348/000712602162463 PMID:11839103

Bonin, P., Fayol, M., & Chalard, M. (2001). Age of acquisition and word frequency in written picture naming. *Quarterly Journal of Experimental Psychology*, *54*(2), 469–489. doi:10.1080/713755968 PMID:11394057

Brase, J., & Raman, I. (2009). The Role of Age of Acquisition in Picture and Word Naming in German. Presented at the Annual Cognitive Section Meeting, BPS, Hertfordshire, UK.

Brown, G. D. A., & Watson, F. L. (1987). First in, first out: Word learning age and spoken word frequency as predictors of word familiarity and word naming latency. *Memory & Cognition*, *15*(3), 208–216. doi:10.3758/BF03197718 PMID:3600260

Brysbaert, M., Lange, M., & Van Wijnendaele, I. (2000). The effects of age-of-acquisition and frequency-of-occurrence in visual word recognition: Further evidence from the Dutch language. *The European Journal of Cognitive Psychology*, *12*(1), 65–85. doi:10.1080/095414400382208

Brysbaert, M., Van Wijnendaele, I., & De Deyne, S. (2000). Age-of-acquisition is a significant variable in semantic tasks. *Acta Psychologica*, *104*, 215–226. doi:10.1016/S0001-6918(00)00021-4 PMID:10900706

Chateau, D., & Lupker, S. J. (2003). Strategic effects in word naming: Examining the route-emphasis versus time-criterion accounts. *Journal of Experimental Psychology. Human Perception and Performance*, *29*(1), 139–151. doi:10.1037/0096-1523.29.1.139 PMID:12669753

Chen, B., You, W., & Zhou, H. (2007a). Age of acquisition effects in reading Chinese: Evidence in favor of the semantic hypothesis. *Acta Psychologica Sinica*, *39*(1), 9–17.

Chen, B., Zhou, H., Dunlap, S., & Perfetti, C. A. (2007b). Age of acquisition effects in reading Chinese: Evidence in favour of the arbitrary mapping hypothesis. *British Journal of Psychology*, *98*(3), 499–516. doi:10.1348/000712606X165484 PMID:17705943

Coltheart, M. (1978). Lexical access in simple reading tasks. In G. Underwood (Ed.), *Strategies of information processing*. San Diego, CA: Academic Press.

Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993). Models of reading aloud: Dual route and parallel distributed processing approaches. *Psychological Review*, *100*(4), 589–608. doi:10.1037/0033-295X.100.4.589

Coltheart, M., & Rastle, K. (1994). Serial processing in Reading aloud: Evidence for Dual-route Models of Reading. *Journal of Experimental Psychology. Human Perception and Performance*, *20*(6), 1197–1211. doi:10.1037/0096-1523.20.6.1197

Cuetos, F., Ellis, A. W., & Alvarez, B. (1999). Naming times for the Snodgrass and Vanderwart pictures in Spanish. *Behavior Research Methods, Instruments, & Computers*, *31*(4), 650–558. doi:10.3758/BF03200741 PMID:10633980

Ellis, A. W., & Lambon Ralph, M. A. (2000). Age of acquisition effects in adult lexical processing reflect loss of placticity in maturing systems: Insights from connectionist networks. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *26*(5), 1103–1123. doi:10.1037/0278-7393.26.5.1103 PMID:11009247

Frederiksen, J. R., & Kroll, J. F. (1976). Spelling and sound: Approaches to the internal lexicon. *Journal of Experimental Psychology. Human Perception and Performance*, *2*(3), 361–379. doi:10.1037/0096-1523.2.3.361

Gerhand, S., & Barry, C. (1999). Age-of-Acquisition and frequency effects in speeded word naming. *Cognition*, *73*(2), B27–B36. doi:10.1016/S0010-0277(99)00052-9 PMID:10580164

Gernsbacher, A. M. (1984). Resolving 20 Years of Inconsistent Interactions Between Lexical Familiarity and Orthography, Concreteness and Polysemy. *Journal of Experimental Psychology. General*, *113*(2), 256–281. doi:10.1037/0096-3445.113.2.256 PMID:6242753

Ghyselinck, M., Custers, R., & Brysbaert, M. (2004). The Effect of Age of Acquisition in Visual Word Processing: Further Evidence for the Semantic Hypothesis. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *30*(2), 550–554. doi:10.1037/0278-7393.30.2.550 PMID:14979824

Gilhooly, K. J., & Logie, R. H. (1980). Age of acquisition, imagery, concreteness, familiarity and ambiguity measures for 1944 words. *Behavior Research Methods and Instrumentation*, *12*(4), 395–427. doi:10.3758/BF03201693

Gordon, B. (1985). Subjective frequency and the lexical decision latency function: Implications for mechanisms of lexical access. *Journal of Memory and Language*, *24*(6), 631–645. doi:10.1016/0749-596X(85)90050-6

Havelka, J., & Tomita, I. (2006). Age of acquisition in naming Japanese words. *Visual Cognition*, *13*(7/8), 981–991. doi:10.1080/13506280544000156

Hino, Y., & Lupker, S. J. (1996). Effects of Polysemy in Lexical Decision and Naming: An Alternative to Lexical Accounts. *Journal of Experimental Psychology. Human Perception and Performance*, *22*(6), 1331–1356. doi:10.1037/0096-1523.22.6.1331

Johnston, R. A., & Barry, C. (2006). Age of acquisition and lexical processing. *Visual Cognition*, *13*(7-8), 789–845. doi:10.1080/13506280544000066

Juhasz, B. J. (2005). Age-of-Acquisition Effects in Word and Picture Identification. *Psychological Bulletin*, *131*(5), 684–712. doi:10.1037/0033-2909.131.5.684 PMID:16187854

Kinoshita, S., & Lupker, S. J. (2002). Effects of filler type in naming: Change in time-criterion or attentional control pathways? *Memory & Cognition*, *30*(8), 1277–1287. doi:10.3758/BF03213409 PMID:12661858

Kinoshita, S., & Lupker, S. J. (2007). Switch costs when reading aloud words and nonwords. *Psychonomic Bulletin & Review*, *14*(3), 449–454. doi:10.3758/BF03194087 PMID:17874586

Lupker, S. J., Brown, P., & Colombo, L. (1997). Strategic control in a naming task: Changing routes or changing deadlines? *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *23*(3), 570–590. doi:10.1037/0278-7393.23.3.570

Monaghan, J., & Ellis, A. W. (2002a). What exactly interacts with spelling-sound consistency in word naming? *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *28*(1), 183–206. doi:10.1037/0278-7393.28.1.183 PMID:11827080

Monaghan, J., & Ellis, A. W. (2002b). Age of acquisition and the completeness of phonological representations. *Reading and Writing*, *15*(7/8), 759–788. doi:10.1023/A:1020958722472

Monsell, S., Patterson, K. E., Graham, A., Hughes, C. H., & Milroy, R. (1992). Lexical and sublexical translation of spelling to sound: Strategic anticipation of lexical status. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *18*(3), 452–467. doi:10.1037/0278-7393.18.3.452

Morrison, C. M., & Ellis, A. W. (1999). Age of acquisition, lexical processing and ageing: Changes across the lifespan. In *Proceedings of the 21st Annual Meeting of the Cognitive Science Society*. Mahwah, NJ: Lawrence Erlbaum Associates.

Morrison, C. M., & Ellis, A. W. (2000). Real age of acquisition effects in word naming and lexical decision. *British Journal of Psychology*, *91*(2), 167–180. doi:10.1348/000712600161763 PMID:10832512

Morrison, C. M., Ellis, A. W., & Quinlan, P. T. (1992). Age of acquisition, not word frequency, affects object naming, not object recognition. *Memory & Cognition*, *20*(6), 705–714. doi:10.3758/BF03202720 PMID:1435273

Paap, K. R., & Noel, R. W. (1991). Dual-rote models of print to sound: Still a good horse race. *Psychological Research*, *53*(1), 13–24. doi:10.1007/BF00867328

Paivio, A., Yuille, J. C., & Madigan, S. A. (1968). Concreteness, imagery and meaningfulness values for 925 words. *Journal of Experimental Psychology Monograph*, *76*(3).

Raman, I. (2006). On the Age of Acquisition Effects in Word Naming and Orthographic Transparency: Mapping specific or universal? *Visual Cognition*, *13*(7/8), 1044–1053. doi:10.1080/13506280500153200

Raman, I., & Baluch, B. (2001). Semantic Effects as a Function of Reading Skill in Word Naming of a Transparent Orthography. *Reading and Writing*, *14*(7/8), 599–614. doi:10.1023/A:1012004729180

Raman, I., Baluch, B., & Besner, D. (2004). On the Control of Visual Word Recognition: Changing Routes Versus Changing Deadlines. *Memory & Cognition*, *32*(3), 489–500. doi:10.3758/BF03195841 PMID:15285131

Raman, I., Baluch, B., & Sneddon, P. (1996). What is the cognitive system's preferred route for deriving phonology from print? *European Psychologist*, *1*(3), 221–227. doi:10.1027/1016-9040.1.3.221

Rastle, K., & Coltheart, M. (1999). Serial and strategic effects in reading aloud. *Journal of Experimental Psychology. Human Perception and Performance*, *25*(2), 482–503. doi:10.1037/0096-1523.25.2.482

Reynolds, M., & Besner, D. (2008). Contextual Effects on Reading Aloud: Evidence for Pathway Control. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *34*(1), 50–64. doi:10.1037/0278-7393.34.1.50 PMID:18194054

Strain, E., Patterson, K., & Seidenberg, M. S. (1995). Semantic effects in single word naming. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *21*(5), 1140–1154. doi:10.1037/0278-7393.21.5.1140 PMID:8744959

Tabossi, P., & Laghi, L. (1992). Semantic priming in the pronunciation of words in two writing systems: Italian and English. *Memory & Cognition*, *20*(3), 303–313. doi:10.3758/BF03199667 PMID:1508055

Yamazaki, M., Ellis, A. W., Morrison, C. M., & Lambon Ralph, M. (1997). Two age of acquisition effects in the reading of Japanese Kanji. *British Journal of Psychology*, *88*(3), 407–421. doi:10.1111/j.2044-8295.1997.tb02648.x

Zevin, J. D., & Balota, D. A. (2000). Priming and attentional control of lexical and sublexical pathways during naming. *Journal of Experimental Psychology. Learning, Memory, and Cognition*, *26*(1), 121–135. doi:10.1037/0278-7393.26.1.121 PMID:10682293

APPENDIX

Table 4. Early and late acquired Turkish words and AoA, imageability and frequency norms with their corresponding English translations and AoA, imageability and frequency norms

Early Acquired Turkish words N=25	AoA	Imageability	Frequency	English Translation	AoA MRC Database N = 10	Imageability MRC Database N = 25	Kucera Francis Frequency MRC Database N= 25
anne	1.10	5.88	1.54	mother	144	638	216
aç	1.48	5.24	1.73	open/hungry*	*	425	319
göz	1.55	5.50	1.54	eye	167	603	122
kedi	1.67	5.02	2.24	cat	*	617	23
ev	1.66	5.48	1.46	house	*	606	591
bebek	1.74	5.70	2.04	baby/doll	*/161	608/565	62/10
oyun	1.80	5.22	2.10	game	242	521	123
saç	1.63	5.08	1.32	hair	*	580	148
şişman	1.30	5.76	1.35	fat	236	574	60
deniz	2.35	5.28	1.58	sea	*	606	95
süt	1.73	5.46	1.92	milk	*	638	49
kardeş	2.04	5.56	1.54	brother	219	589	73
makas	2.00	5.90	1.47	scissors	*	609	1
güneş	2.02	5.62	1.64	sun	181	639	112
gece	2.12	5.30	1.38	night	222	607	411
kapı	2.08	5.00	1.44	door	214	599	312
uçak	2.24	4.85	2.27	plane	*	556	114
bardak	2.04	5.12	1.76	glass	*	585	99
erkek	2.20	5.10	1.58	man	*	567	1207
ateş	2.20	5.52	2.60	fire	*	634	187
sabah	2.10	5.26	1.26	morning	*	579	211
çocuk	2.00	5.56	1.50	child	*	619	213
balık	2.14	5.12	2.74	fish	*	615	35
yatak	2.16	5.08	1.51	bed	169	635	127
ayı	1.96	4.66	3.00	bear	*	572	57
MEAN	1.89	5.33	1.78		196	593	199
SD	0.31	0.32	0.46		35	45	249
Late Acquired Turkish words N=25	**AoA**	**Imageability**	**Frequency**	**English Translation**	**AoA MRC Database N = 8**	**Imageability MRC Database N = 20**	**Kucera Francis Frequency MRC Database N = 22**
aday	4.88	4.76	2.06	candidate	578	452	34
af	4.37	4.96	2.08	amnesty	*	*	*
göç	4.73	4.92	2.03	migration	*	*	10
katı	4.24	4.35	2.63	solid	*	*	77
et	3.78	5.33	2.18	meat/flesh	*	618/567	45/52
bilim	5.42	5.00	1.69	science	458	423	131
otel	4.80	4.94	1.55	hotel	308	697	126
sap	3.84	5.31	1.57	stem	*	533	29
şafak	4.67	5.16	2.26	dawn	350	586	28
daire	3.88	5.02	1.46	circle	522	556	81
sert	3.47	4.86	1.98	hard	*	460	202
kilit	4.29	4.95	1.68	lock	328	532	23
mantar	3.40	5.55	1.88	mushroom	*	*	2
gümüş	4.14	4.98	2.08	silver	317	582	29
genç	3.63	5.45	1.70	young	*	521	385
kriz	5.26	4.50	2.26	crisis	*	375	82
ulus	5.10	5.15	2.35	nation	425	436	139
boyut	5.42	4.76	1.39	size	*	415	138
esmer	4.02	5.33	1.44	brunette	*	*	*
albay	5.02	5.00	2.38	colonel	*	522	37
sanat	5.06	5.06	2.22	art	*	493	208
çağdaş	5.24	5.10	2.38	modern/new	*	368	198
beygir	5.42	5.06	2.31	nag/horse	*	508/624	*
yaşam	4.56	4.92	1.46	life	*	482	715
ak	4.86	5.36	2.08	white	*	556	365
MEAN	4.54	5.03	1.96		411	512	141
SD	0.64	0.30	0.36		102	87	166

* denotes to missing value in the English norms; *N* number of English translations with normative data

Filler words (N=50) with their corresponding English translations and AoA, Imageability and Frequency ratings, Letter and Syllable length

Table 5. Experiment 2

HF Filler Word	Translation	AoA	Imageability	Frequency	Letter Length	Syllable Length
okul	school	2.37	5.60	1.18	4	2
insan	human	2.63	5.67	1.32	5	2
söz	word	2.92	4.76	1.37	3	1
uyku	sleep	2.33	5.23	1.38	4	2
sınıf	class	3.45	4.92	1.51	5	2
kitap	book	2.45	5.65	1.52	5	2
soğuk	cold	2.49	4.92	1.54	5	2
isim	name	2.35	4.98	1.60	4	2
duygu	feeling	4.47	5.06	1.60	5	2
sevinç	joy	3.88	5.22	1.60	6	2
erken	early	3.27	4.69	1.61	5	2
mavi	blue	2.35	4.75	1.62	4	2
yavaş	slow	3.22	4.60	1.70	5	2
merak	curiosity	3.88	4.75	1.70	5	2
haber	news	3.42	4.86	1.70	5	2
esya	furniture	2.84	4.86	1.71	4	2
özel	private	4.73	4.80	1.72	4	2
dünya	world/earth	2.98	5.71	1.72	5	2
rahat	comfortable	3.98	4.42	1.76	5	2
son	end	3.53	4.66	1.76	3	1
toplum	community	5.02	5.21	1.76	6	2
tek	single/sole	3.10	4.86	1.78	3	1
karar	decision	4.47	4.92	1.78	5	2
defter	exercise-book	2.64	5.16	1.78	6	2
uzun	long	2.73	4.60	1.80	4	2
soru	question	2.76	4.78	1.80	4	2
sabır	patience	4.84	4.94	1.80	5	2
fikir	idea	5.02	5.10	1.82	5	2
sayı	number	2.92	5.32	1.82	4	2
bilgi	information	4.20	4.70	1.84	5	2
giysi	clothing	2.60	5.04	1.84	5	2
suç	crime	3.40	4.72	1.86	3	1
zengin	rich	3.72	4.94	1.86	6	2
resim	picture	2.45	5.08	1.86	5	2
aşk	love	4.14	5.08	1.86	3	1
deli	mad	2.86	4.83	1.88	4	2
doktor	doctor	2.34	5.46	1.88	6	2
kural	rule/regulation	4.20	5.00	1.92	5	2

continued on following page

Table 5. Continued

HF Filler Word	Translation	AoA	Imageability	Frequency	Letter Length	Syllable Length
basit	simple	4.16	4.22	1.96	5	2
inat	stubbornness	3.67	4.76	1.96	4	2
tarak	comb	2.60	4.96	1.96	5	2
can	life/soul	3.38	5.09	1.98	3	1
yazı	writing	2.80	5.25	2.0	4	2
güç	power	3.59	5.02	2.02	3	1
ters	opposite	3.87	4.15	2.04	4	1
tavuk	chicken	2.35	4.65	2.04	5	2
yalan	lie	2.90	4.80	2.04	5	2
umut	hope	4.96	4.85	2.04	4	2
yeşil	green	2.34	5.04	2.04	5	2
salak	idiot	3.51	4.40	2.08	5	2
	MEAN SD	3.34 .82	4.94 .34	1.77 .20	4.54 .86	1.84 .37

Table 6. Experiment 3

MF Filler Word	Translation	AoA	Imageability	Frequency	Letter Length	Syllable Length
ayar	adjustment	5.2	4.27	3.50	4	2
taviz	concession	5.58	4.23	3.52	5	2
kaygan	slippery	4.53	4.44	3.53	6	2
eser	masterpiece	4.98	5.21	3.53	4	2
tekne	boat	3.41	4.44	3.54	5	2
evcil	domesticated	4.44	4.60	3.54	5	2
ihtiras	desire	5.86	4.32	3.55	7	3
dernek	organization	5.52	4.77	3.58	6	2
pul	stamp	3.92	4.88	3.58	3	1
müracaat	application	5.48	4.56	3.59	8	4
miting	meeting	5.58	4.90	3.59	6	2
parmaklık	railings	4.32	4.60	3.60	9	3
evren	universe	5.14	4.92	3.62	5	2
sıfat	adjective	4.92	4.38	3.63	5	2
ilim	science	5.22	4.84	3.63	4	2
kumar	gamble	5.16	4.46	3.64	5	2
oruç	fasting	4.22	5.16	3.64	4	2

continued on following page

Table 6. Continued

MF Filler Word	Translation	AoA	Imageability	Frequency	Letter Length	Syllable Length
kalıtsal	genetic	5.67	4.35	3.65	8	3
antlaşma	agreement	5.27	4.66	3.66	8	3
entrika	intricate	5.98	4.10	3.70	7	3
gereksinme	necessity	6.0	4.44	3.71	10	4
züppe	pretentious	5.46	4.36	3.73	5	2
esnek	flexible	4.88	4.15	3.74	5	2
kale	castle	3.04	4.85	3.75	4	2
denetim	inspection	5.59	4.27	3.78	7	3
tutsak	captive	5.02	4.56	3.78	6	2
bağlaç	conjunction (gram)	5.27	4.08	3.82	6	2
buluş	invention	5.29	4.62	3.82	5	2
uçurtma	kite	2.76	5.00	3.82	7	2
tahrip	destruction	5.82	4.19	3.83	6	2
boru	pipe	3.46	4.00	3.86	4	2
izmarit	cigarette butt	5.02	4.52	3.86	7	3
iman	belief	5.14	4.92	3.88	4	2
tasa	worry	4.96	4.23	3.90	4	2
kasırga	hurricane	5.20	4.45	3.90	7	3
sendika	syndicate	5.78	4.57	3.90	7	3
tüfek	rifle	3.06	5.04	3.90	5	2
fener	torch	3.43	4.58	3.92	5	2
töre	custom	5.46	4.69	3.94	4	2
körfez	gulf	5.02	4.60	3.96	6	2
çapraz	cross	5.02	4.35	3.98	6	2
simge	symbol	5.33	4.50	3.98	5	2
istikrar	power	5.88	4.40	4.0	8	3
örf	custom	5.67	4.62	4.0	3	1
görenek	custom	5.67	4.77	4.02	7	3
çeyiz	trousseau	5.20	4.79	4.02	5	2
sömürge	colony	5.54	4.51	4.04	7	3
tren	train	2.33	4.87	4.04	4	1
küp	cube	4.14	4.53	4.06	3	1
hamam	bath	3.62	4.66	4.24	5	2
	MEAN SD	4.89 .91	4.56 .28	3.78 .18	5.62 1.59	2.24 .66

Table 7. Experiment 4

LF Filler Word	Translation	AoA	Imageability	Frequency	Letter Length	Syllable Length
esir	prisoner of war	4.70	2.65	4.00	4	2
yosun	moss	4.18	3.82	4.06	5	2
baygın	unconscious	4.86	3.14	4.08	6	2
vali	governor	4.84	3.56	4.08	4	2
sanayi	industrial	5.36	4.60	4.08	6	3
tekel	monopoly	5.45	3.91	4.10	5	2
zelzele	earthquake	4.27	2.88	4.16	7	3
çelik	steel	5.20	3.56	4.16	5	2
vefa	loyalty	5.82	2.83	4.18	4	2
ok	arrow	3.12	2.92	4.18	2	1
dikey	perpendicular	5.04	4.23	4.18	5	2
veznedar	cashier	5.45	2.44	4.20	8	3
sürgün	exiled	5.08	1.48	4.22	6	2
inci	pearl	3.78	3.98	4.22	4	2
küme	group	4.50	2.52	4.24	4	2
bellek	memory	5.65	3.41	4.29	6	2
baldır	calf	4.58	4.26	4.29	6	2
verem	tuberculosis	4.88	2.52	4.32	5	2
yetim	orphan	4.68	3.98	4.32	5	2
gevrek	crisp	4.52	4.10	4.39	6	2
tezkere	discharge (army)	5.86	4.52	4.45	7	3
hisse	share	5.90	4.36	4.50	5	2
hilal	crescent	5.02	3.86	4.51	5	2
peri	fairy	3.61	4.24	4.53	4	2
baston	cane	3.38	4.40	4.56	6	2
ilik	bone marrow	4.69	3.73	4.58	4	2
diyar	land	5.28	4.38	4.60	5	2
yazgı	fate	5.77	2.58	4.65	5	2
zurna	oboe	4.33	2.64	4.65	5	2
gelgit	tide	5.54	2.28	4.67	6	2
serüven	adventure	5.54	2.35	4.67	7	3
kuşatma	siege	5.50	4.24	4.70	7	3
yarıçap	circumference	5.40	3.04	4.73	7	3
saçak	eave	5.04	2.12	4.74	5	2

continued on following page

Table 7. Continued

LF Filler Word	Translation	AoA	Imageability	Frequency	Letter Length	Syllable Length
türbe	tomb	4.96	2.56	4.76	5	2
bayır	meadow	5.04	2.43	4.80	5	2
çıban	spot	4.48	4.10	4.80	5	2
fosil	fossil	5.59	4.26	4.98	5	2
çığır	era	5.58	2.80	5.00	5	2
yayla	plateau	4.94	2.65	5.02	5	2
bulgu	result	5.92	3.94	5.02	5	2
benek	spot	4.67	3.88	5.04	5	2
vampir	vampire	4.53	2.42	5.08	6	2
havan	mortar	4.84	2.02	5.37	5	2
gedik	gap	5.46	2.65	5.39	5	2
peçe	veil	5.10	4.54	5.44	4	2
yele	mane	5.02	4.25	5.56	4	2
tunç	bronze	4.98	2.90	5.57	4	1
us	mind	5.81	2.15	5.80	2	1
irin	pus	5.16	3.62	5.80	4	2
	MEAN SD	4.97 .64	3.33 .84	4.63 .48	5.10 1.17	2.08 .44

Table 8. Experiment 6

HI Filler Word	Translation	Frequency	Imageability	AoA	Letter Length	Syllable Length
çirkin	ugly	2.12	4.75	2.82	6	2
ince	thin	2.18	4.69	2.86	4	2
koltuk	armchair	1.18	4.96	2.30	6	2
ayna	mirror	1.18	5.00	2.32	4	2
toprak	soil	1.18	6.33	2.78	6	2
sigara	cigarette	1.20	6.32	3.04	6	3
tepsi	tray	1.38	4.85	3.14	5	2
yaprak	leaf	1.40	5.00	2.52	6	2
dosya	file	1.42	5.04	4.25	5	2
fırın	oven	1.44	4.86	3.0	5	2
zeytin	olive	1.44	6.14	2.39	6	2
rengarenk	colorful	1.50	4.80	3.98	9	3
köy	village	1.52	5.08	2.92	3	1

continued on following page

Table 8. Continued

HI Filler Word	Translation	Frequency	Imageability	AoA	Letter Length	Syllable Length
yurt	homeland	1.66	5.28	4.52	4	1
berber	barber	1.74	4.62	3.24	6	2
balkon	balcony	1.74	5.00	2.58	6	2
uzman	expert	2.74	5.00	5.43	5	2
gitar	guitar	1.76	4.76	3.60	5	2
basın	press	2.76	5.10	5.32	5	2
biber	pepper	1.78	4.75	2.52	5	2
yoksul	poor	1.80	5.20	4.12	6	2
belge	document	1.81	4.82	4.90	5	2
gölge	shadow	1.82	4.96	3.51	5	2
düğme	button	1.84	4.65	2.55	5	2
kutu	box	1.86	4.71	3.06	4	2
deprem	earthquake	2.86	4.86	3.88	6	2
bahçe	garden	1.86	6.30	2.51	5	2
bitkin	tired	2.92	4.69	5.8	6	2
şiir	poem	2.92	4.98	4.33	4	2
altın	gold	1.94	6.20	3.56	5	2
fare	mouse	1.96	4.50	2.51	4	2
sakat	disabled	1.98	4.78	3.76	5	2
damar	vein/artery	1.98	4.98	4.24	5	2
bayrak	flag	1.98	6.56	2.71	6	2
gemi	ship	1.02	4.94	2.43	4	2
tepe	hill	1.04	4.62	3.06	4	2
iğne	needle	1.04	4.78	2.56	4	2
çilek	strawberry	1.10	4.60	2.74	5	2
ipek	silk	2.18	5.06	4.12	4	2
sivri	sharp	2.26	4.73	3.57	5	2
damla	drop	2.26	4.83	3.74	5	2
kare	square	2.40	4.62	3.71	4	2
cadı	witch	3.43	4.69	3.02	4	2
kızıl	scarlet	1.43	4.77	4.78	5	2
nehir	river	2.44	4.87	3.53	5	2
kıyı	shore	2.46	4.73	4.44	4	2
saray	palace	2.10	4.78	3.65	5	2
yiğit	brave	3.31	4.96	4.92	5	2
kule	tower	3.37	4.81	3.39	4	2
	MEAN SD	3.47 .86	5.02 .51	1.93 .62	5.04 1.01	2.02 .32

Table 9. Experiment 7

MI Filler Word	Translation	Frequency	Imageability	AoA	Letter Length	Syllable Length
güzel	pretty/beautiful	1.40	5.10	2.32	5	2
rüya	dream	1.46	4.90	2.98	4	2
heyecan	excitement	1.82	4.65	4.14	7	3
mantık	logic	2.88	4.87	5.21	6	2
güven	security	2.92	4.24	4.65	5	2
tarih	history	2.54	4.86	4.16	5	2
çözüm	solution	2.74	5.00	4.65	5	2
yürek	heart/soul	4.14	5.10	4.29	5	2
yemin	vow	3.20	4.79	4.18	5	2
fakir	poor/needy	2.20	5.06	3.59	5	2
kibar	refined	2.22	4.94	4.0	5	2
eşit	equal	2.24	4.85	4.34	4	2
sarı	yellow	2.28	4.72	2.33	4	2
hüzün	sadness	2.30	4.68	5.33	5	2
kanun	law	2.30	5.00	4.64	5	2
görev	duty	2.30	5.06	4.55	5	2
birey	individual	2.31	5.06	5.42	5	2
işlem	procedure	2.37	4.79	4.75	5	2
şiddet	severity; violence	2.38	4.82	4.69	6	2
öneri	proposal	3.39	4.81	5.22	5	3
burç	bastion	4.43	4.90	4.90	4	1
bulut	cloud	2.47	5.17	2.86	5	2
barış	peace	2.52	4.40	3.86	5	2
güncel	topical	2.53	4.62	5.39	6	2
onur	honour	2.53	5.12	5.41	4	2
müjde	good news	3.90	4.90	4.16	5	2
vicdan	conscience	4.62	5.17	5.45	6	2
bayram	festival	2.62	5.51	2.72	6	2
sevda	love	2.64	4.62	5.22	5	2
gayret	effort	3.66	4.96	4.65	6	2
adil	just	3.78	5.12	5.53	4	2
lisan	language	3.79	5.06	4.96	5	2
kayıt	registration	2.88	4.81	5.14	5	2
ölçü	measurement	3.40	4.68	4.18	4	2
hizmet	service	3.50	5.00	5.37	6	2

continued on following page

Table 9. Continued

MI Filler Word	Translation	Frequency	Imageability	AoA	Letter Length	Syllable Length
şeref	honour	3.64	4.74	5.39	5	2
uygar	civilised	3.80	5.04	5.53	5	2
denge	balance	3.90	4.85	5.12	5	2
anı	memory	3.08	4.36	4.86	3	2
oy	vote	3.12	5.12	4.88	2	1
çerçeve	frame	3.20	4.80	4.24	7	3
azim	willpower	3.20	4.96	5.30	4	2
ahmak	foolish	3.24	4.84	4.02	5	2
yasa	law	3.24	4.90	5.18	4	2
zihin	cognition	3.24	5.12	5.28	5	2
örgüt	association	3.35	4.74	5.78	5	2
gür	plentiful	4.44	4.64	4.69	3	1
kitle	mass	3.47	4.67	5.62	5	2
verim	production	3.48	4.74	5.22	5	2
güngörmüş	wise	5.52	4.66	5.80	9	3
	MEAN SD	4.64 .87	4.78 .23	3.05 .82	4.98 1.08	2.02 .38

Table 10. Experiment 8

LI Filler Word	Translation	Frequency	Imageability	AoA	Letter Length	Syllable Length
hayal	imagination	2.18	2.40	4.51	5	2
eksik	missing	2.50	3.29	3.46	5	2
genel	general	2.62	3.40	4.88	5	2
berbat	terrible	2.26	3.18	4.86	6	2
çeşit	variety	2.78	3.19	4.41	5	2
uygulama	application	3.73	2.58	5.33	8	4
önlem	precaution	2.93	2.42	4.85	5	2
günah	sin	2.85	2.26	4.02	5	2
serseri	tramp	4.50	2.59	4.30	7	3
gönül	heart/mind	2.50	2.65	4.91	5	2
kaba	rude, thick	2.80	3.56	4.16	4	2
kıyaslama	comparison	2.54	2.54	5.56	9	4
dönem	term	2.74	3.34	4.80	5	2
dizi	series	2.54	4.39	3.78	4	2

continued on following page

Table 10. Continued

LI Filler Word	Translation	Frequency	Imageability	AoA	Letter Length	Syllable Length
bela	trouble	2.65	2.20	4.72	4	2
uyarı	warning	2.90	3.54	4.86	5	3
boşluk	emptiness	2.69	2.42	4.29	6	2
rakip	opponent	4.73	2.58	4.84	5	2
tutku	passion	3.74	2.52	5.54	5	2
aşama	level	3.79	2.56	5.76	5	3
uyuz	idle	3.83	3.42	4.57	4	2
kin	hate	3.86	2.44	4.98	3	1
taklit	mimicking	2.90	3.42	4.32	6	2
savunma	defense	2.96	2.64	5.40	7	3
müddet	time	3.02	3.43	5.32	6	2
dargın	cross/upset	3.08	2.43	3.82	6	2
siyasi	political	3.08	2.44	5.58	6	3
biçim	shape/form	3.16	2.63	4.24	5	2
katil	murderer	3.29	4.33	4.22	5	2
bayat	stale	3.30	3.41	3.98	5	2
kavram	concept	3.33	2.02	5.54	6	2
eylem	action	3.44	3.54	5.32	5	2
mağdur	victim	6.49	3.52	6.0	6	2
doyum	satiety	4.50	2.56	5.04	5	2
ihale	auction	5.16	2.29	5.66	5	3
üvey	step-(family members)	4.23	3.54	4.92	4	2
kısır	infertile	4.30	2.04	5.42	5	2
felek	fate/destiny	5.54	2.64	5.41	5	2
evre	universe	5.55	3.15	5.88	4	2
evliya	saint	6.54	2.22	5.20	6	3
külfet	inconvenience	6.34	2.68	5.57	6	2
beniz	colour of the face	5.35	2.62	5.56	5	2
buhran	crisis	6.51	2.30	6.04	6	2
iblis	devil	6.61	2.22	5.35	5	2
tümce	sentence	5.65	2.48	5.24	5	2
gürz	mace	6.87	1.54	5.91	4	1
güdük	short/stunted	6.12	2.54	5.70	5	2
ati	future	6.18	2.10	5.69	3	2
ablak	dull	6.29	2.22	5.17	5	2
	MEAN SD	4.98 .65	2.78 .60	4.01 1.44	5.24 1.08	2.18 .56

Table 11. Experiments 5 and 10

Nonword Fillers	
apuk	oroy
aj	böglö
apran	takef
botkan	abü
berzik	selek
cuto	derkit
çifre	tark
deset	gülç
evsol	sö
fazur	tilme
gaj	aylap
genzit	ölez
hesel	irel
ircin	iratak
kenyip	çorkaz
küç	mektil
merki	kefröz
pepi	gataf
süp	caratlı
tapul	cava
ignör	çiren
gisye	dopul
yumin	evsol
yanoç	firan
yusi	gavar