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# Transliteration and transcription effects in bi-scriptal readers:

# The case of Greeklish

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## Abstract

In order to overcome limitations associated with script incompatibilities Greek users of the Internet have developed *Greeklish*, a transliterated version of Modern Greek using Roman characters. The representational status of this artificial writing system was examined in two masked priming lexical decision experiments using Greeklish primes with different degrees of graphemic overlap with their corresponding Greek targets. Results suggested that Greeklish primes were effectively processed and transliterated to their Greek counterparts. Larger masked priming effects were found as a function of increased prime-target graphemic overlap. Interestingly, these Greeklish priming effects were in all cases of smaller magnitude than the pure Greek identity priming effect. Our findings revealed that extensive experience with a recently developed artificial writing system leads to its non-effortful processing, but that even for highly experienced Greeklish users the Greeklish-to-Greek conversion is modulated by the graphemic properties of the input stimulus.

**Transliteration and transcription effects in bi-scriptal readers:**

**The case of Greeklish**

If Archimedes were to communicate his enthusiasm of his discovery that any floating object displaces its own weight of fluid to his Greek peers through an online social network, he would most probably had written "*Eyrhka!*" instead of *"Εύρηκα!"* [Eureka!]. This informal way of writing Greek words with Roman characters, called *Greeklish*, has been developed by Greeks in an effort to overcome software and hardware limitations associated with the use of the Greek alphabet in electronic communication (see also Romaji for Japanese). This Greek-to-Greeklish conversion (broadly termed as transliteration) relies either on the phonemic or the graphemic overlap of a given Greek letter with a Roman one. For the subgroup of letters that sound and look the same across the two alphabets (e.g., *o*), and for script-specific graphemes that map onto the same phoneme (e.g., *φ-f,* which map onto /f/), the output of the Greek-to-Greeklish transliteration does not vary. Note, however, that a reduced set of Greek letters can map on different Roman letters, such as the Greek letter *ω*, that can be mapped onto *o* on the basis of the phonemic overlap, or onto *w* on the basis of a graphemic criterion. This way, Greeklish transliterations usually have extensive phonemic overlap (e.g., *μήλο -milo* [apple] are pronounced like /milo/) while the degree of graphemic overlap can vary from very limited (e.g., *ζύμη-zymi* [barm]) to almost complete (e.g., *σοκάκι-sokaki* [alley]). Technically, the term transliteration refers to the act of representing a given string in a language with a formal representation from a different code (e.g., script) following the phoneme-to-grapheme conversion rules of this new code. If the relations between graphemes and phonemes are similar in both codes, transliterations are considered to be transcriptions. Accordingly, Greeklish conversions with high graphemic overlap with respect to the Greek base words, for which the Roman graphemes sounding the same as the Greek graphemes are visually similar, are better defined as transcriptions. In contrast, when the Roman graphemes associated to the phonemes do not visually resemble those graphemes from the Greek alphabet, the Greeklish conversions are exclusively characterized as transliterations. A well-known instance of transliterations can be found in languages using different writing systems, such as Katakana-Kanji transliterations of Japanese with extensive phonemic overlap but null graphemic overlap (see Hino, Lupker, Ogawa, & Sears, 2003). A transcription-transliteration distinction similar to the Greeklish-Greek one is found in the Cyrillic-Roman correspondences that guide Serbian script alternations (e.g., Havelka & Rastle, 2005); while some of the Roman and Cyrillic graphemes that map on the same Serbian phoneme are visually very close or identical (transcribed letters like a-а, b-б), others are visually distinct (transliterated letters like l-л, c-ц).

In order to ensure the fluidness of the intended virtual communication, it is expected that experienced users of Greeklish would have developed a series of highly internalized processes to perform Greek-to-Greeklish and Greeklish-to-Greek conversions. The present study uses the masked priming paradigm (Forster & Davis, 1984) to examine the level of automaticity of these conversion processes in Greeks who are exposed to Greeklish on a daily basis. In the masked priming paradigm a pattern mask is first presented, followed by the brief presentation of a prime (for around 50 ms), and then by the target. Crucially, under these conditions participants are unaware of the existence of the prime, while its influence can still be measured on the processing of the target. We used Greek words as targets (e.g., *φώκια* [seal]) and their Greeklish versions as primes (e.g., *fwkia*) while manipulating their degree of graphemic overlap (transcriptions vs. transliterations). Taking into account the extensive exposure of young Greeks to Greeklish, the multidimensional Greek-Greeklish relation (i.e., a common lexico-semantic representation, almost complete phonemic overlap and a varying degree of graphemic overlap) as well as previous reports of cross-script and cross-language masked repetition priming effects (e.g., Gollan, Forster, & Frost, 1997; Nakamura, Dehaene, Jobert, Le Bihan, & Kouider, 2007) we expected a *Greeklish masked priming effect* to emerge.

Given that Greeklish-Greek pairs map onto the same lexico-semantic representation, their processing could resemble that of translation equivalents. Similar to what could be assumed for Greeklish-Greek transliterations or transcriptions, it has been shown that masked primes facilitate the processing of their translation equivalent via the pre-activation of the shared meaning (see Duñabeitia, Perea, & Carreiras, 2010, for review). However, and especially for Greeklish-Greek conversions that have extensive grapho-phonemic overlap, that is, for Greeklish-Greek transcriptions (e.g., *fwkia-φώκια* [seal]) there is a greater resemblance to translations with extended but not complete graphemic overlap (i.e., *non-identical cognates;* e.g., *guitar* and its Spanish translation, *guitarra*). These types of translations have been found to lead to larger masked translation priming effects as compared to non-formally overlapping ones (i.e., *non-cognates*; e.g., *dog* and its Spanish translation, *perro*; e.g., Duñabeitia et al., 2010-a). Contrarily, the processing of the Greeklish conversions sharing most of their phonemes but only a very small number of graphemes with their Greek base word, that is, Greeklish-Greek transliterations (e.g., *βλήμα-vlima* [missile]) mostly resembles that of cross-script cognates or of cross-script transliterations (e.g., Katakana-Kanji for Japanese), which have extensive phonemic but very limited graphemic overlap on top of the semantic overlap (see Hino et al., 2003; Voga & Grainger, 2007).

In spite of their similarity with transliterations (or with translation equivalents, the fact that Greeklish is a recently created artificial writing system suggests that the sublexical (graphemic and phonemic) overlap across the two codes should be critically involved in the processing of Greeklish items. Previous studies have revealed a clear dissociation between the influence of graphemic and of phonemic overlap on the early stages of reading (e.g., Dimitropoulou, Duñabeitia, & Carreiras, 2011; Grainger & Holcomb, 2009). In the case of Greeklish reading, the graphemically overlapping letters between Greeklish and Greek could provide a visual cue for the reader to match each Greeklish item to its corresponding Greek word. Alternatively, the extensive and more invariant phonemic overlap across the Greeklish-Greek pairs could also be triggering the identification of the correct Greek word upon the presentation of its Greeklish version, similar to how masked phonological priming effects emerge (e.g., *brane-BRAIN*; Dimitropoulou et al., 2011; see Rastle & Brysbaert, 2006, for review).

The present study describes two lexical decision experiments examining Greeklish masked priming effects. Experiment 1 aimed at testing whether the Greeklish-to-Greek conversion takes place in an unconscious way in experienced users of Greeklish, by using Greeklish transcriptions as primes and their Greek correspondences as targets (e.g., *sokaki-σοκάκι* [alley]). We furthermore compared the processing of Greeklish transcriptions to that of pure Greek repetitions (e.g., *σοκάκι-σοκάκι*). In the bilingual literature comparable repetition priming effects within- and across-languages have been only obtained with balanced bilinguals, thought to process words from both their languages equally effectively (e.g., Duñabeitia et al., 2010-b). Taking into account that Greeklish is only used for specific communication purposes, we expected the Greeklish masked priming effect to be significantly smaller than the Greek identity priming effect, reflecting the fact that even for experienced users of Greeklish, Greek is the dominant linguistic code.

## Experiment 1

### Method

**Participants:** 44 native Greek speakers with extensive reading and writing exposure to Greeklish completed this experiment (see Table 1 for a full description of the participants' use of Greeklish).

-Table_1-

**Materials:** Two hundred 5 and 6-letter Greek target words were taken from the GreekLex database (Ktori, Pitchford, & Van Heuven, 2008), and their Greeklish correspondences were obtained. These Greek-Greeklish pairs were transcriptions (not transliterations) given their extensive graphemic and phonemic overlap, measured as the number of visually close or undistinguishable graphemes and the number of shared phonemes. In order to identify the overlapping graphemes, 20 Spanish college students without any knowledge of the Greek alphabet were asked to indicate which of the Greek lowercase letters could be perceived as a known Roman letter. We considered overlapping those graphemes that were indicated to be visually similar by at least 70% of the sample (i.e., *α-a, ε-e, ι-i, ο-o, τ-t, κ-k, χ-x, ω-w*). The selected Greeklish-Greek repetitions had 70% and 92% of overlapping graphemes and phonemes, respectively, as measured at the individual character fine-grained level. We further corroborated that the strings were also graphemically similar at the coarse-grain level by asking another 32 Spanish readers to rate the Greeklish-Greek pairs in a 1-to-5 scale (5 referring to highly similar). Mean similarity score for the pairs was 4.2. The position of the graphemic overlap varied across the prime and target strings. Greek targets (e.g., *σοκάκι* [alley]) were preceded by masked primes that were i) their Greek repetition (e.g., *σοκάκι*), ii) their Greeklish transcriptions (e.g., *sokaki*), iii) a Greek unrelated word (e.g., *δάπεδο* [floor]), or iv) the Greeklish version of the unrelated word (e.g., *dapedo)*. Greek base words used in the unrelated (Greek and Greeklish) conditions were matched as closely as possible to the targets (see Table 2). Furthermore, in order to confirm the extended use of the Greeklish version of the Greek words, we computed the number of times each precise Greeklish word form had been used in a Greeklish-to-Greek online translator (Chalamandaris et al., 2006). Greeklish transcriptions were on average used more than 300 times, suggesting that they were uniformly accepted as valid Greeklish items. Moreover, ratings on whether each Greeklish transcription was considered as the preferred Greeklish version of the target were collected by 20 Greeklish users who did not participate in the experiment. On a 1-to-7 scale (7 representing “the best” Greeklish transcription) the Greeklish transcriptions were rated at 6.9. A set of 200 pronounceable Greek nonwords (e.g., *παδέμο*) was also created. These nonwords were preceded by Greek or Greeklish repetition or unrelated nonword primes. Four lists were constructed so that each target appeared only once in each list, each time in a different priming condition. Different participants were randomly assigned to each list.

-Table_2-

**Procedure:** Participants were individually tested in a well-lit soundproof room. The presentation of the stimuli and recording of the responses was carried out using DMDX (Forster & Forster, 2003). On each trial, a forward mask (i.e., ######) was presented for 500ms. Next, the prime was presented for 50ms immediately followed by the target, which remained on the screen for a maximum of 2500ms. Primes were presented centered in lowercase 10pt Courier New (character width: 0.12 inches) and targets in lowercase 12pt Courier New (character width: 0.16 inches), in order to avoid overlapping pixels. Participants were instructed to press, as quickly and accurately as possible, one of two buttons on the keyboard to indicate whether the target was a legitimate Greek word or not. They were not informed of the presence of the primes and none of them reported conscious knowledge of their existence. Trial presentation was randomized across participants. Each participant received a total of 12 practice trials (6 words and 6 nonwords). The experimental session lasted approximately 15 minutes.

**Results and Discussion**

Incorrect responses and reaction times shorter than 250ms or greater than 1500ms (less than 2.5% of the word data) were excluded from the analysis. Mean latencies for correct responses and error rates are presented in Table 2. ANOVAs on reaction times and error rates by participants and items were conducted based on a 2(Type of relationship: Repetition/Unrelated) x 2(Script: Greek/Greeklish) x 4(List: 1/2/3/4) design.

ANOVAs on reaction times revealed a main effect of Type of relationship: targets were responded to faster (28ms) when preceded by related primes than when preceded by unrelated primes, $F_1(1,40)=106.08$, $p<.001$; $F_2(1,196)=54.37$, $p<.001$. The main effect of Script was not significant (a 6 ms difference, both *ps*>.13). Critically, the interaction between the two factors was significant $F_1(1,40)=15.37$, $p<.001$; $F_2(1,196)=10.98$, $p<.01$. Subsequent pairwise comparisons showed faster responses (40ms) to targets primed by their exact Greek repetitions as opposed to unrelated Greek primes, $F_1(1,40)=77.41$, $p<.001$; $F_2(1,196)=48.73$, $p<.001$. Targets were also responded to faster (15ms) when primed by their Greeklish transcriptions than by unrelated Greeklish primes, $F_1(1,40)=18.55$, $p<.001$; $F_2(1,196)=9.37$, $p<.01$, even though the magnitude of the identity priming effect was significantly larger than the Greeklish priming effect (a 25ms difference).

ANOVAs on the arcsin transformed[1] error rates did not reveal any significant effects (all *ps*>.11).

The nonword data did not reveal any significant effects (all *ps*>.13).

Experiment 1 showed a significant masked identity priming effect with Greek primes as well as a Greeklish masked priming effect with Greeklish transcriptions,

[1] We opted for using the arcsin transformation due to the fact that a large part of the error data was gathered near the lower limit of the percentage range (0%) thus violating ANOVA's assumption about the free variation of data around the mean (see Jaeger, 2008).

suggesting that for experienced users of Greeklish, the Greeklish-to-Greek conversion takes place in a ballistic and unconscious manner. However, the significant difference in the magnitude of the Greeklish-Greek and Greek-Greek priming effects suggests that Greeklish transcriptions activate their Greek correspondences less effectively than Greek repetition primes. We interpret this difference as reflecting a distinction at the graphemic level of processing, since the graphemic overlap was not total (70%), while the phonemic overlap was almost complete (92%). A strong graphemic component in the Greeklish masked priming effect would predict that under similar circumstances Greeklish *transcriptions* should lead to larger Greeklish masked priming effects than Greeklish *transliterations,* due to the increased graphemic overlap. Experiment 2 was designed to address this issue by examining Greeklish masked priming effects produced with Greeklish transcriptions and transliterations.

## Experiment 2

### Method

**Participants:** A different group of 46 native Greek speakers with extensive exposure to Greeklish and matched to the group who completed Experiment 1 took part in this Experiment (see Table 1).

**Materials:** 200 five-letter Greek targets were selected from the Greeklex database. Following the results of the questionnaires described in Experiment 1, these words were divided in two groups: a *transliteration group*, if they had only 1-2 common graphemes with their Greeklish counterpart (mean of 30% graphemic overlap; e.g., *βλήμα-vlima* [missile]), and a *transcription group* if they had 3-4 common graphemes (mean of 70% graphemic overlap; e.g., *fwkia-φώκια* [seal]). To avoid providing a processing advantage for either transcriptions or transliteration due to uneven distribution of onset overlap, none of the transcription or transliteration Greeklish-Greek pairs selected overlapped in their initial grapheme. Each Greek target was preceded by i) its Greeklish transliteration/transcription or by ii) a semantically and formally unrelated perfectly matched Greeklish word (see Table 3). The same procedure used in Experiment 1 was followed to validate the quality of the Greeklish items according to the Greeklish-to-Greek online translator. Greeklish converted forms from the transcribed and transliterated groups were used on average more than 230 times by expert Greeklish users ($p>.85$). According to the offline questionnaires, the appropriateness of the Greeklish transliteration/transcription primes was rated with 6.5 in the 1-to-7 scale. An additional set of 200 five-letter Greek pronounceable nonwords was also created, which were presented preceded by Greeklish related and unrelated primes. Priming conditions and materials were counterbalanced in two lists, and different participants were randomly assigned to each of them.

-Table_3-

**Procedure:** The same procedure as in Experiment 1 was followed.

**Results and Discussion**

Less than 1.5% of the word data were excluded from the analysis following the same data trimming procedure as in Experiment 1. Mean latencies for correct responses and error rates are presented in Table 3. ANOVAs on the reaction times and error rates by participants and by items were conducted based on a 2(Degree of overlap: Transcription/Transliteration) x 2(Type of relationship: Related/Unrelated) x 2(List: list 1/2) design.

ANOVAs on the reaction times revealed a main effect of Type of relationship: participants responded faster to the targets (20ms) when primed by their Greeklish counterparts than by unrelated Greeklish forms, $F_1(1,44)=29.23$, $p<.001$; $F_2(1,98)=29.75$, $p<.001$. A main effect of Degree of overlap (marginally significant in the $F_2$ analysis) was also found, showing that targets in the transcription group were responded to faster (16ms) than targets in the transliteration group, $F_1(1,44)=18.59$, $p<.001$; $F_2(1,98)=3.45$, $p=.07$. Importantly, the two factors significantly interacted with each other, $F_1(1,44)=4.53$, $p<.05$; $F_2(1,98)=4.81$, $p<.05$. Despite the significant Relatedness effect found for the transliterated group (12ms) [$F_1(1,44)=5.52$, $p<.05$; $F_2(1,98)=10.48$, $p<.01$], the Relatedness effect found for the transcribed group was significantly larger (28ms) [$F_1(1,44)=27.29$, $p<.001$; $F_2(1,98)=22.63$, $p<.001$].

ANOVAs on the arcsin transformed error rates revealed a main effect of Degree of overlap, $F_1(1,44)=31.55$, $p<.001$; $F_2(1,98)=5.04$, $p<.05$. The rest of the effects were not significant (all *ps*>.17).

ANOVAs on the nonword data did not reveal any significant effects (all *ps*>.32).

Experiment 2 replicated the Greeklish masked priming effect with both *transcriptions* and *transliterations*, despite the different graphemic overlap. Interestingly, results showed a graded pattern induced by the increased graphemic similarity of transcriptions as opposed to transliterations. These findings suggest that the magnitude of the Greeklish priming effect is directly proportional to the number of overlapping graphemes between related primes and targets and reveal the existence of a strong graphemic component in the Greeklish masked priming effect.

## General Discussion

The present study examined the level of automaticity of the conversion of Romanized (Greeklish) transliterated and transcribed versions to their corresponding Greek words and the extent to which this process is influenced by graphemic overlap. To this end, Greek targets were presented briefly preceded by their Greeklish versions, with extensive phonemic overlap but varying degrees of graphemic overlap (transcriptions vs. transliterations). In Experiment 1, experienced users of Greeklish showed a significant Greeklish masked priming effect with pairs with high graphemic overlap (transcriptions), which was in turn smaller than the Greek identity priming effect. With a similar sample of Greeklish users, Experiment 2 revealed larger priming effects for transcriptions as compared to transliterations (high vs. low graphemic overlap, respectively), underlining the strong sublexical/graphemic component of the Greeklish effect.

The overall pattern of Greeklish masked priming effects closely resembles the one reported with transliterations (e.g., Kana-Kanji for Japanese). In further detail, the magnitude difference between the Greek-Greek and the Greeklish-Greek repetition priming effects found in Experiment 1 is highly similar to the pattern obtained by Nakamura et al. (2007), who found that priming effects for Kanji-Kanji repetitions were larger than with

Kana-Kanji transliterations with Japanese speakers that were more familiar with the Kanji than with the Kana writing system.

In Experiment 2 we obtained a clear-cut graded pattern of Greeklish masked priming effects that was strongly modulated by the amount of graphemic overlap (transcriptions vs. transliterations). A similar influence of graphemic overlap has been previously reported in bilingual studies testing masked translation priming effects, where larger effects have been reported for cognates as compared to non-cognates (Duñabeitia et al., 2010-a) as well as for cognates with increased formal overlap as compared to cognates with less overlapping units (Voga & Grainger, 2007).

The overall pattern of Greeklish masked priming effects indicates that the graphemic overlap is a prerequisite for their appearance, and that priming effects for highly overlapping transcriptions like *fwkia-φώκια* are larger than for less overlapping transliterations like *vlima-βλήμα*. Intuitively, one might argue that the Greeklish priming effects obtained follow the same regularization mechanisms that govern the LEET priming effects obtained with repetition primes containing letter-like symbols or numbers (e.g., *M4T3R14L-MATERIAL*; Carreiras, Duñabeitia, & Perea, 2007; Kinoshita & Lagoutaris, 2010; Molinaro, Duñabeitia, Marín-Gutiérrez, & Carreiras, 2009). LEET effects have been proposed to result from a regularization process of the features of the letter-like characters (e.g., numbers or symbols) embedded in the primes driven by the complete match between the prime-target letters (e.g., Carreiras et al., 2007; Molinaro et al., 2009). Nonetheless, even though such a feature-based regularization process could be involved in the enhanced transcription (high graphemic overlap) Greeklish effect, it cannot be considered to be entirely driving all the observed Greeklish effects, since significant effects were obtained not only for transcriptions but also for transliterations (with low graphemic overlap) in which 70% of the units were mismatching between prime and target. In turn, we believe that the origin of Greeklish priming effects stems from grapheme (not feature) overlap, localized at a more abstract level of case-specific representations involving size, font, color, position and orientation invariant letter representations (e.g., Dehaene, Cohen, Sigman, & Vinckier, 2005)[2]. This proposal is based on evidence showing that masked repetition priming effects are insensitive to feature overlap (i.e., the same amount of repetition priming is typically found for pairs with high and low feature overlap like *kiss*-*KISS* and *gear*-*GEAR*; Kinoshita & Kaplan, 2008, for review).

Critically, in both experiments the phonemic overlap across the Greeklish-Greek repetitions was nearly complete (above 85%). Although it has been shown that masked phonological priming effects can be obtained even when the graphemic overlap is non-existent and the phonemic overlap is incomplete (e.g., Dimitropoulou et al., 2011; Rastle & Brysbaert, 2006), the difference in the magnitude of the Greeklish priming effects for transcriptions and transliterations suggests that the Greeklish effect is mainly driven by the graphemic and not by the phonemic overlap. This proposal provides support to the so-called "weak phonological theory", which in contrast to theories of "strong phonology"

[2] Given that the Greeklish priming effects were obtained with same case (lowercase) Greeklish-Greek prime-target pairs we are can only assume the involvement of case-specific graphemic representations in the appearance of the effects. Future research testing the persistence of the effects when Greeklish primes and Greek targets are presented in different cases could identify whether these graphemic representations are situated higher in the orthographic processing stream, at a case-independent level of abstract letter identities. The authors want to thank an anonymous Reviewer for bringing this into our attention.

(Frost, 2003), posits that the early stages of visual word recognition depend on the orthographic, and to a lesser extent on the phonological properties of the input stimulus (e.g., Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001). Current research in our lab is aimed at obtaining evidence regarding the influence of the phonemic overlap and its interaction with the graphemic overlap in the overall pattern of Greeklish priming effects, by testing Greeklish-Greek pairs with limited phonemic overlap and extensive graphemic overlap.

In summary, our results provide a first approximation into the processing of a recently developed artificial writing system (Greeklish). We present evidence showing that words written in Greeklish are unconsciously processed and that they effectively activate the lexico-semantic representations of real Greek words. However, this activation depends on the graphemic overlap between the Greeklish-Greek strings, showing for the first time that transcriptions are more effectively processed than transliterations.

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**Table 1**

Mean values of exposure and usage of Greeklish per week as calculated by the self-ratings of the participants of Experiment 1 and Experiment 2.

| | | Experiment 1 | Experiment 2 |
|---|---|---|---|
| Greeklish reading | Hours/week | 13.1 | 13.4 |
| Greeklish writing | Hours/week | 11.2 | 9.2 |
| Emails in Greeklish | % received | 44 | 54 |
| | % sent | 42 | 53 |
| Online messaging in Greeklish | Hours/week | 9.5 | 12 |
| | % of total time | 79 | 87 |
| Online forums in Greeklish | Hours/week | 7.7 | 5.9 |
| | % of total time | 66 | 90 |

**Table 2**

Examples of the word materials with their lexical properties as well as mean lexical decision times (RTs, in ms) and error rates (Err%) obtained in Experiment 1. Graphemic and phonemic overlap is given as the mean number of position specific common graphemes or phonemes between primes and targets. Mean percentage of overlap and reaction time and error rate standard errors are presented within parentheses.

| | | Greek | | | Greeklish | | |
|---|---|---|---|---|---|---|---|
| | Target | Primes | | Effect | Primes | | Effect |
| | | *Repetition (R)* | *Unrelated (UR)* | *(UR-R)* | *Transcription (T)* | *Unrelated (UR)* | *(UR-T)* |
| | *σοκάκι* (alley) | *σοκάκι* | *δάπεδο* (floor) | | *sokaki* | *dapedo* | |
| *Frequency* | 22 | 22 | 21 | | 22 | 21 | |
| *Length* | 5.7 | 5.7 | 5.7 | | 5.7 | 5.7 | |
| *Graph. Overlap* | - | 5.7 (100%) | 0.0(0%) | | 4.0 (70%) | 0.0 (0%) | |
| *Phon. Overlap* | - | 5.7 (100%) | 0.0 (0%) | | 5.2 (92%) | 0.0 (0%) | |
| *RTs* | | 659 (16.1) | 699 (15.6) | 40 | 677 (15.3) | 692 (16.5) | 15 |
| *Err%* | | 3.8 (0.7) | 4.3 (0.6) | 0.5 | 4.0 (0.5) | 4.0 (0.6) | 0.0 |

*Note:* Mean reaction time and error rate (within parentheses) for nonwords were: 775ms (3.5%) and 783ms (3.8%) in the Greek repetition and unrelated conditions; and 786ms (4.3%) and 782(3.7%) in the Greeklish repetition and unrelated conditions. *Graph*., Graphemic, *Phon*., Phonemic, *Ov*., Overlap.

**Table 3**

Examples of the word materials with their lexical properties as well as mean lexical decision times (RTs, in ms) and error rates (Err%) obtained in Experiment 2. Graphemic and phonemic overlap is given as the mean number of position specific common graphemes or phonemes between primes and targets. Mean percentage of overlap and reaction time and error rate standard errors are presented within parentheses.

| | Transliteration (Low graphemic overlap) | | | | Transcription (High graphemic overlap) | | | |
|---|---|---|---|---|---|---|---|---|
| | Target | Greeklish Primes | | Effect | Target | Greeklish Primes | | Effect |
| | | *Related (R)* | *Unrelated (UR)* | *(UR-R)* | | *Related (R)* | *Unrelated (UR)* | *(UR-R)* |
| | *βλήμα* (missile) | *vlima* | *tafos* (grave) | | *φώκια* (seal) | *fwkia* | *stani* (sheepfold) | |
| *Frequency* | 18 | 18 | 16 | | 17 | 17 | 16 | |
| *Length* | 5 | 5 | 5 | | 5 | 5 | 5 | |
| *Graph. Ov.* | - | 1.5 (30%) | 0.0 (0%) | | - | 3.5 (70%) | 0.0 (0%) | |
| *Phon. Ov.* | - | 4.3 (87%) | 0.3 (1%) | | - | 4.4 (88%) | 0.0 (0%) | |
| *RTs* | | 695 (14.1) | 707 (14.4) | 12 | | 703 (13.5) | 731 (14.4) | 28 |
| *Err%* | | 4.4(0.6) | 3.8 (0.6) | -0.6 | | 7.1 (0.8) | 6.5 (1.0) | -0.6 |

*Note:* Mean reaction time and error rate (within parentheses) for nonwords were: 776ms (2.6%) and 779ms (2.9%) in the related and the unrelated conditions, respectively. *Graph*., Graphemic, *Phon*., Phonemic, *Ov*., Overlap.