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Gender activation in transparent and opaque words

Mabel Urrutia, Alberto Domínguez and Carlos J. Álvarez
Universidad de La Laguna

Two reaction time experiments were carried out to examine the morphological gender processing of Spanish words that were either transparent —that is, ending in o/a (e.g., banco - bank)—or opaque—that is, without superficial gender marking (e.g., virtud - virtue). In Experiment 1, participants categorized the gender of a transparent gender target preceded by a derived word of the same gender (e.g., banquillo-dock, masculine) or of different gender (e.g., banqueta-stool, feminine). A negative priming gender effect indicates the use of strategic-attentional mechanisms to decide the gender of the target, but also automatic computation of the prime gender. Experiment 2 used a lexical decision task with the stimuli of Experiment 1 in addition to opaque gender words. The results show longer reaction times for transparent gender words with regard to opaque items. This effect was possibly due to the lexical requirements of the task: lexical decision, and also because transparent words are morphologically more complex than opaque words. Finally, in both experiments, there was negative priming: when prime and target were of the same gender, reaction times were longer. This effect indicates that participants cannot ignore the gender of the prime when they respond to the target.

Activación de género en palabras transparentes y opacas. Dos experimentos de tiempo de reacción se realizaron para evaluar el procesamiento del género en palabras del español con género transparente, terminadas en -o/-a (e.g., banco) y palabras opacas, terminadas en consonantes (e.g., virtud). En el experimento 1 los participantes efectuaron una tarea de categorización de género en la que debían decidir el género de un target precedido por una palabra del mismo género (e.g., banquillo-BANCO) o de diferente género (e.g., banqueta-BANCO). Los resultados indicaron un efecto de priming negativo, esto indica el uso de una estrategia atencional para decidir el género del target, pero también un cálculo automático del género del prime. En el experimento 2 se realizó una tarea de decisión léxica con los mismos estímulos del experimento 1, añadiéndose estímulos de género opaco. Los resultados mostraron tiempos de reacción más largos para palabras de género transparente con respecto a las opacas, esto porque las primeras son morfológicamente más complejas que las segundas y también a que se trata de tareas léxicas distintas. En ambos experimentos encontramos un efecto de priming negativo cuando prime y target correspondían al mismo género. Este efecto podría indicar que los participantes no pueden ignorar el género del prime cuando responden al target.

Gender has important communicative functions, such as the disambiguation of anaphoric structures or deictic reference; it increases sentence cohesion thereby facilitating processing, and also has cataphoric functions for the prediction of the following phrase structures (Van Berkum, 1996; Van Berkum et al., 2005). There have been many studies of how gender agreement operations are carried out within the sentence. In Italian, Bates et al. (2006), used three different tasks (word repetition, gender classification and grammaticality judgement), and presented an adjective-noun sequence. They obtained a facilitation effect when gender was in agreement in the three tasks, compared to a neutral gender condition (gender suffix not indicating gender) and an inhibition effect (longer reaction times) in word pairs which did not agree in gender, in the word repetition task. According to these authors, the facilitation effects indicate that gender is a lexical characteristic which is processed early in word recognition and automatically activated, in order to facilitate comprehension of the succeeding lexical elements which agree in gender. In contrast, the inhibitory effects would be more related to post-lexical strategic processing.

In German, Hillert & Bates (1996) also found facilitatory effects when the gender of an article agreed with the noun's gender marker, and an inhibitory effect when there was disagreement. In Dutch, van Berkum (1996) concluded that the role of gender in word recognition depends on the nature of the task. In a lexical decision task, he found facilitatory effects in word pairs with concordant gender, an effect that was not found for the naming task, where concordant gender pairs of words produced longer times than neutral pairs.

Our aim is only indirectly related to syntactic processing of word agreement. We are more interested in knowing whether the assignation of gender is an automatic, obligatory process in lexical

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Correspondencia: Mabel Urrutia Martínez
Facultad de Psicología
Universidad de La Laguna
38205 Santa Cruz de Tenerife (Spain)
E-mail: murrutia@ull.es

access. In other words, we want to explore if gender is identified on the basis of surface, prelexical information of the word, such as the presence of the suffixes -a/-o, or if, on the contrary, gender information is only retrieved at a postlexical stage when agreement between one word and the other has to be computed. In addition, another related goal is to examine the morphological changes in the lexical memory when a word with a specific gender is activated; for example: what other words from the same family are also activated?

One characteristic of Spanish gender which is crucial for morphological word processing is the presence of surface gender markers: The suffixes *-o/-a* indicate masculine and feminine gender, respectively, for example with *niño/niña* (*boy/girl*). Words with these markers are gender-transparent. However, there are also many words of opaque gender because they do not end in a specific morpheme, for example, *lápiz* (pencil*) or reloj (*clock*)*. This characteristic could force the language producer/comprehender to carry out different operations to assign the gender of the word, depending on if they are transparent or opaque. While the gender of transparent words can be processed superficially and prelexically (detecting the suffix -a/-o), the gender of opaque words would require lexical processing (Holmes & Seguí, 2004). These differences were supported by a recent study (Hernández et al., 2004), using functional magnetic resonance imaging (fMRI), where it was seen that there was an increase in brain activity for the opaque items as opposed to the transparent items in areas related to morphological processing, indicating a greater cognitive «effort» of agreement in this type of words to determine their gender.

In the first experiment of our study, these transparent words were presented in a gender categorization task; opaque gender words were added in a second experiment using the lexical decision task. Our aims were to find out how the activation of a word with a specific gender (banco-*bank*) changes as a function of the previous presentation of another word derived from it, where the prime could have the same gender (banquillo-*dock*) or different gender (banqueta-*stool*). Furthermore, we expect these experiments to shed some light on the morphological organization of lexical memory, by providing data about the amount of activation received by words from the same morphological family (i.e., those sharing the same stem and differing in gender).

Another aspect of this study is the use of derived words as primes (e.g., banquillo-*banco*). The morphological structure of these kinds of words is complex, as it is made up of a stem (banc-), a derivative suffix (-*ill*-) and finally an inflected suffix of gender (-*o*). There were three reasons to employ these types of words: First, because in most studies of gender processing, «simple» words have been used, with the gender suffix attached directly to the stem. Second, the percentage of derived words in Spanish is very high. And third, we wanted to explore if possible effects of shared stem and shared gender suffixes are simply additive (both morphological relations cause facilitation) or if, on the contrary, there is some kind of interaction between the two types of morphological overlap between words.

Predictably, and based on previous studies, when a gender-specified word is presented there is additional activation of other lexical items which share the same stem and the same gender, while members of the same morphological family with the opposite gender will remain deactivated or even inhibited. (Hernández et al., 2004).

In Experiment 1, a gender categorization task was used (Bates et al., 1996; Holmes & Seguí, 2004). Participants had to make a decision about the gender of the target words. Because this task necessarily involves the computation of gender, we hope to maximize the possible effects of the manipulated factors: shared or differing stem and gender agreement. Words with transparent gender (i.e., «a/o» suffixed) were presented as targets because they are the most common and secure way of marking gender: 99.87% of the forms finished in «O» are masculine words, and 96.30% of the forms finished in «A» are feminine words (Bergen, 1978). It indicates that there are some exceptions in Spanish like «mano», «moto», whose gender is masculine and vice versa «mapa», «dogma» with feminine gender. As previously mentioned, the assignment of gender can be carried out strategically (by simply attending to the end of the word and determining if they see an *-a* or an *-o*). Therefore, in Experiment 2, we compared both transparent and opaque words in a lexical decision task.

Our results will depend on how automatic the gender assignment processes is, the prelexical or postlexical level at which the cognitive assignment of gender is produced, and also on the specific task demands. If the results are the same with both tasks, we think that this will provide evidence for automatic gender processing at a lexical or prelexical stage, and not at a postlexical stage.

Experiment 1

Method

Participants

40 undergraduate students from the first year of Speech Therapy at the University of La Laguna participated in this experiment in order to obtain extra course credit. All were native speakers of Spanish, with normal or corrected-to-normal vision. The age range was 18-25 years.

Materials and design

Sixty nouns were selected as targets. All of them had transparent gender, ending in -o/-a. Half of them were feminine and half were masculine words. These target words were equivalent in length, with a minimum of two and a maximum of three syllables. The mean number of letters was 5.16 and the mean word frequency was 111.18 per million according to Alameda & Cuetos (1995). Mean maginability was 4.4270 (Davis & Perea, 2005). For each of the targets, four words were selected according to a 2×2 experimental design. The first factor, Gender Agreement, had two levels: same and different (prime and target), and the second factor, Stem, referred to the pairs of words which could have the same stem (being the prime a derived word and the target a word without a derivative suffix) or a non-related word (when the stem was not shared). Thus, each target was paired with four primes, for example, the target BANCO *(bank)* was paired with the prime *banquillo (dock)* in the same gender/same stem condition; with the prime listillo *(little smart)* in the same gender/different stem condition; with the prime *banqueta (stool)* in the different gender/same stem condition, and finally, with the prime *coleta (pigtail)* in the different gender/different stem condition.

The stimuli were counterbalanced so that each participant saw 15 word-word pairs in each one of the four experimental conditions. Thus, all the participants went through all the conditions but saw each target only once. The presentation of the word pairs was random to avoid the use of predictive strategies in the gender categorization task.

Procedure

The participants carried out the experiment individually in sound-proofed booths. The experiment was run using the DmDx software (Forster & Forster, 2003). Each participant received training with seven stimuli before the 60 experimental trials and 60 additional opaque targets fillers were presented to avoid the use of a direct strategy of «look at the end and decide gender». Since lexical factors such as length, frequency and imaginability were not controlled, comparisons between opaque and transparent words were not possible. Each trial began with a 500 ms fixation point in the centre of the computer screen, which was then replaced by the stimulus. The prime was presented for 250 ms and was then immediately replaced by the target stimulus. All the prime words were presented in lower case letters while the targets were presented in capital letters to avoid possible iconic or sensory memory effects. The participant's task was to pay attention to the two words presented and answer only about the second. The participants were instructed to answer as quickly and accurately as possible whether the gender of this word was feminine or masculine. The response was made by pressing one of two buttons on a «Logitech Gamepad» response device, with a loss of approximately 1ms. Possible handedness effects were controlled for by counterbalancing the response buttons.

Results

The mean reaction times and percentage of errors for each condition are shown in Table 1. All items with a reaction time above 2 seconds and with a mean error rate more than 50% were eliminated. In total, 0.62% of the data were eliminated (15 items). An ANOVA of the response latencies for the correct answers revealed a significant effect for participants and marginally for items of the first factor, Gender Agreement, ($F1(1,39)= 3.96$, $Mse= 2823.76$, $p<.05$; $F2(1,59)= 3.40$, $Mse= 4228.74$, $p= .07$): There was a significant inhibition of the response in those words preceded by words of the same gender. Furthermore, there was a significant facilitation in the responses to words preceded by primes with the same stem ($F1(1,39)= 8.39$, $Mse= 3288.04$, $p<.001$; $F2(1,59)= 8.55$, $Mse= 5237.15$, $p<.001$).

The analysis on error rates showed no significant effects.

Table 1
Mean reaction times and percentage of errors (in parentheses) in Experiment 1 with a Gender categorisation task

Target	Gender	Stem	RT (% err)
BANCO	Same	Same	856 (4.66) banquillo
		Different	883 (4.83) listillo
	Different	Same	840 (4.33) banqueta
		Different	865 (4.33) coleta

Discussion

The stem facilitation effect indicates that there is a processing benefit for the targets which are preceded by another word with the same stem. This priming effect has been dissociated from purely formal or semantic effects in other languages (Feldman, 2000; Drews & Zwitserlood, 1995; Rastle et al., 2000) as well as in Spanish (Domínguez et al., 2002; Sánchez-Casas et al., 2003), although we have not done this in this study, as this was not our main objective.

The gender factor (same/different) produced a very surprising result. As we have seen, readers take less time at the task when the target has a different gender in both words. A first conclusion is that the mere presentation of the prime produces a computation of the gender even when the task does not demand this operation. Only the target gender should be computed to accomplish adequately the task.

On the other hand, the *negative priming* effect would seem to indicate that gender assignment is carried out superficially, without accessing the lexicon, and as a consequence of an attentional mechanism. To determine the gender of a word, it is sufficient to pay attention to the end of the word and to decide if it ends in -a or -o for feminine or masculine, respectively. However, it seems that to do this, is necessary to inhibit the gender of the prime, as it is irrelevant. It is during this inhibition that the negative priming probably takes place. It is true that the negative gender priming effect may be a strategic task-induced effect. Additionally, it is important to note that we are forcing the participants to use their metalinguistic knowledge. If we use a task that does not focus the participants' attention on the gender of the word, such as a lexical decision task, we should obtain facilitation in those pairs which share gender**.** Since we have taken the negative gender priming to imply an automatic computation of gender, the use of lexical decision task would provide evidence that gender is a characteristic which is automatically processed. Therefore, at a lexical level, the activation of a word of a particular gender makes this gender more available for other word of the same morphological family, thus speeding response times.

Experiment 2

This experiment attempts to examine the gender effect obtained in Experiment 1 with a lexical decision task, a task which does not focus on the metalinguistic knowledge of the reader, and should therefore reduce confounding effects due to strategic mechanisms of attention. An additional objective was the introduction of a new variable, transparency, by including targets which have alternative or gender-opaque endings, such as VIRTUD, to test whether or not the effect of the gender variable is independent of the presence or absence of a superficial mark such as the suffixes -o/-a.

Method

Participants

46 students from introductory Psychology courses participated voluntarily in order to obtain course credits. They were all native speakers of Spanish with normal or corrected-to-normal vision. The age range was 18-25 years.

Materials

We selected 120 nouns as targets. Sixty of these had transparent gender, ending in -o/-a, and were exactly the stimuli of the experiment 1. The other 60 words had opaque gender. Half were feminine words and half were masculine. The mean number of letters was 5.65 for the opaque words, a lexical frequency of 110.03 and a mean of 4.26 for imaginability. No statistical difference was found between opaque words and transparent words (see appendix with means for opaque and transparent words). For each of the targets, e.g., VIRTUD-*VIRTUE*, four derived words were selected like primes: same gender and same stem e.g. virtuosa-*virtuous woman*; different gender and same stem e.g. virtuoso-*virtuous man*; same gender and different stem e.g. tramposa-*cheat woman* and different gender and different stem e.g. tramposo-*cheat man*.

Design

A 2×2×2 experimental design was used. The first factor, Transparency had two levels: Transparent gender and opaque gender. The second factor, Gender, also had two levels: Same and different (prime and target) and the third factor, Stem, referred to the pairs of words which could have the same stem (with the prime a derived word and the target a word without a derivative suffix) or a non-related word (when the stem was not shared). Thus, each target was paired with 4 primes.

A set of one hundred pairs of word/pseudoword were added as fillers (there were 20 fewer fillers than the word/word pairs in order to shorten the experiment and avoid fatigue and inattention of participants). Half of the pseudoword foil targets ended in -a/o and the other half had different endings. The primes of the word-pseudoword pairs were selected in such a way that it was not possible to give a lexical decision response based on the presence or absence of relationships between the prime and target. Thus, we used 25 derived transparent words which shared initial letters with the pseudoword targets (e.g., Dudoso-DURSO), 25 derived transparent words which did not share any other letters with the target, except that both ended in -o/a (e.g. Mímica-PLABA), 25 derived opaque words which shared initial letters with the pseudoword targets (e.g. blancor-BLUSE) and 25 derived opaque words which were not orthographically related to the target (e.g. invasor-PITERAL).

Procedure

The same as in the previous experiment except that the participants had to decide whether the target was a word or a non-word. As in experiment 1, participants received 7 training items before the 120 experimental items which were randomised with the 100 word-pseudoword pairs.

Results

The mean reaction times, as well as the percentage of errors in each experimental condition, are shown in Table 2. The total percentage of errors was 3.55. Items which had a response time above 2 seconds were eliminated (0.27% of the data). Repeated measure ANOVAs on the response times to the correct answers were run. A significant effect of transparency was found: The participants took longer to decide about the transparent words (704ms) than about the opaque words (689ms). This effect was significant only by subjects [F1(1,45)= 10.76, Mse= 1843.96, p<.01; F2>1].

In the case of the variable Stem, the ANOVA indicates that when words belong to the same morphological family, target recognition benefits from the previous semantic processing of the prime. (F1 (1,45)= 111.10, Mse= 1872.53, p<.001; F2 (1,118)= 55.92, Mse= 5362.26, p<.001).

The variable Gender Agreement only yielded significant effects by items (F1 (1,45)= 1.92,Mse= 4348.39, p= .17; F2 (1,118)= 4.40, Mse= 2796.29, p<.05). This effect is modulated by a triple interaction of transparency x gender agreement x stem (F1 (1,45)= 5.36, Mse= 2266.94, p<.05; F2 (1, 118)= 5.35, Mse= 2772.08, p<.05).

Further separate ANOVAs were carried out for transparent and opaque words. A significant effect of the variable Gender Agreement in transparent words was found (F1(1,45)= 6.11, Mse= 2619.95, p<.05; F2(1,59)= 5.92, Mse= 3562.51, p<.05), but not in opaque words. That is, there is an inhibition effect as in the previous experiment. This effect is modulated by the interaction of gender agreement x stem (F1(1,45)= 7.41, Mse= 1892.33, p<.01; F2(1,59)= 6.86, Mse= 2333.82, p<.05). Inhibition is greater when prime and target have the same gender, but different stems. On the other hand, the factor Stem yielded significant facilitation in both, transparent words (F1(1, 45)= 40.75, Mse= 1740.64, p<.001; F2(1,59)= 27.18, Mse= 3903.90, p<.001), and opaque words (F1(1,45)= 74.47, Mse= 1925.57, p<.001; F2(1,59)= 29.51, Mse= 6820.61, p<.001).

Error analyses showed only a significant effect of Stem (F1(1,45)=18.28, Mse=20.97, p<.001, F2(1,118)=5.93, Mse=1.10, p<.05): participants had more errors when the stem of the prime differed from that of the target.

Discussion

The first important result was that transparent words produced longer reaction times than opaque words. The most plausible explanation for this is that words such as *virtud*-virtue *or reloj*-clock, which we have termed gender-opaque, are generally monomorphemic, that is, they need no type of segmentation or separation of morphemes as there is only one morpheme involved. In contrast, words ending in -o/a such as *banco*-bank are inflected words, with a gender suffix. In terms of morphological analysis,

Table 2
Mean reaction times and percentage of errors (in parentheses) in Experiment 2 with a Lexical decision task

Transparency	Target	Gender	Stem	RT (% err)
Transparent	BANCO	Same	Same	685 (3.47) banquillo
			Different	741 (5.07) listillo
		Different	Same	683 (2.17) banqueta
			Different	705 (4.63) coleta
Opaque	VIRTUD	Same	Same	664 (4.05) virtuosa
			Different	714 (5.79) tramposa
		Different	Same	658 (3.04) virtuoso
			Different	720 (5.36) tramposo

these words are more complex than the opaque words. Monomorphemic words would then be represented in memory in a whole-word form and accessed directly, while transparent words would have a stem representation in the lexical memory and a separate analysis of the gender suffix will be carried out. The task required consulting the lexicon before deciding. This could be why reaction times to opaque words were longer in this experiment.

In the second experiment, however, the negative gender priming effect was also observed, confirming the results of Experiment 1: When the prime and target were of the same gender, the reaction times were longer. This effect was observed only in the transparent and not in the opaque words. However, in Experiment 2 we did not ask the participants to make metalinguistic decisions about the gender of the word, or to direct their attention to the suffixes. Thus, a strategic (conscious) explanation of the negative priming effect can be ruled out. It seems, rather, that gender is a characteristic of the word that is automatically processed. This interference effect occurs when one word precedes another with the same gender only if gender is detected by applying a rule such as the -o/-a masculine-feminine rule. In addition, this inhibition was greater when primes and targets do not share the same stem. It is likely that the inhibition due to a shared gender suffix was reduced because of facilitation from a shared stem.

General Discussion

Two experiments were carried out with different tasks: gender categorisation and lexical decision. The categorisation task in Experiment 1 allowed participants to make a superficial analysis based on word-ending of the transparent stimuli. This attention-dependent strategy produced a negative effect on the target gender determination, probably due to the previous presentation of a similar gender prime. The observed stem priming effect suggests morphological processing of words. «In the lexical decision task, used in Experiment 2, opaque words were added in order to compare transparent and opaque words. Factors such as frequency, length and imaginability were controlled (see Alija & Cuetos, 2006 for comparison between main lexical variables). As the lexical decision task requires processing at the lexical memory level, reaction times were faster when the word was less morphologically complex (opaque) monomorphemic words such as *virtud* (virtue), than in a transparent condition with morphologically complex gender suffixes. On the other hand, in line with the results of Experiment 1, the negative priming for pairs of words with the same gender was replicated in the transparent words. However, this effect was not obtained when the words were gender opaque.

In general, reaction times in the two experiments were much longer in the gender categorisation task than in the lexical decision task, which implies a higher cognitive cost for the first task. As mentioned above, the gender-categorisation task is a metalinguistic task that is very different from what normally occurs during reading. However, we think that the results provide important clues about the role of superficial orthographic information in gender assignment.

The stem effect in Experiment 1 indicates that a morphological segmentation of the word, separating the suffix from the stem, is actually being carried out. The effect of negative priming is not only an attentional effect, but also provides information about the resources that participants are spending when they are reading the prime. The categorization task does not demand any operation on the prime, however, the negative priming effect denotes that the reader is paying attention to the prime gender. If this were not the case, no negative priming would be produced.

The lexical decision task used in Experiment 2 may provide better information about what is happening in the lexicon without asking the participant for any morphological information. The participants took more time to decide if a stimulus is a word when it was gender-transparent, such as *mito*, than when it was gender-opaque, such as *reloj*. We think that this result points to a lexical access mechanism which was not required for the gender categorisation task (in Experiment 1). The existence of -a/o suffixes does not provide any kind of information about whether the stimuli is a word or not. The need to access the lexicon for all the stimuli, and the fact that the transparent words are morphologically complex, results in longer reaction times in response to these stimuli. The processing of opaque words produced similar reaction times in a study with a task similar to ours, carried out by Hernández et al. (2004), with fMRI. Their results showed that brain activity was greater in areas B44/45 of the left hemisphere when participants read opaque words. It is known that these areas are particularly activated when the task consists in producing the article or determiner of a given noun (Heim et al., 2002). This «syntactic» operation was defended also by Holmes & Seguí (2004) applied to opaque gender words.

One other interesting effect is the inhibition produced in the pairs of same-gender words (masculine-masculine or feminine-feminine), which occurred in both tasks and which was only significant when the target word ended in a suffix -o/a. This is the effect that some authors have termed Negative Priming (Ortells & Tudela, 1996; Tipper, 1985; Versace & Allain, 2001), and is a strategic attentional effect (Macizo, Bajo, & Soriano, 2006). As in these experiments, the prime presentation time is sufficient for conscious recognition, the participant cannot avoid recognising the gender of the prime. However, this does not result in any processing benefits, as the gender of the prime can coincide or not with that of the target. Thus, the task requires inhibiting the gender of the prime because the gender cannot be ignored. If prime and target have differing genders, this has no effect on the reaction times. However, if the gender of the two words is the same, and the reader has inhibited the gender of the prime, then there is an increase in the categorization time of the target. When the prime is a derived word from the target (and shares the stem with the last), however, this gender-based inhibition is reduced because the facilitation produced by the activation of those words of the same morphological with the same stem, as suggested by results of Experiment 2.

Facilitation and inhibition effects for gender congruency varied according to language and to the kind of task used. Friederici & Jacobsen (1999), postulate that facilitation effects are more variable than inhibition effects. The formers are associated to phonological influence since the presentation of stimuli was auditory, such as in French and Italian (For a detailed review on gender across languages, see Friederici et al., 1999). Contrary to the behaviour of facilitation effects, inhibition effects are observed regardless of the types of tasks and languages and they are explained by the assumption of a intralexical model, which connects both given information of prime and target.

In summary, our most important finding is that the gender of the prime is processed in an automatic and obligatory way, whether or not this is relevant to task completion. Secondly, conflict only arises between the prime and target if the gender is represented in the word transparently and explicitly by a suffix (-o/a), and not when there is no gender marker at this surface level. This means that negative priming is not the result of mere inhibition of response when two stimuli are similar, but due to the processing of the gender which is only obligatory when this is marked by a typical suffix.

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Appendix 1
Transparent Gender

SAME		**DIFFERENT**					
Related	**Non related**	**Related**	**Non related**	**TARGET**	**Length**	**Frequency**	**Imaginability**
Pescadería	Cafetería	Pescador	Aviador	PESCA	5	15	5,3
Astrónomo	Fisónomo	Astrología	Teología	ASTRO	5	4	-1
Galantería	Enfermería	Galanteo	Devaneo	GALA	4	20	3,5
Hilillo	Rabillo	Hilacha	Borracha	HILO	4	40	6,37
Gotera	Playera	Gotero	Arquero	GOTA	4	24	6,08
Banquillo	Listillo	Banqueta	Coleta	BANCO	5	52	5,68
Ventanilla	Cocinilla	Ventanuco	Caduco	VENTANA	7	163	6,49
Friolero	Perchero	Friolera	Pradera	FRÍO	4	131	-1
Camilla	Astilla	Camastro	Hijastro	CAMA	4	206	7
Abrigado	Amparado	Abrigada	Cuchillada	ABRIGO	6	40	6,72
Puntería	Notaría	Puntero	Casillero	PUNTA	5	65	5,23
Carretero	Pordiosero	Carretera	Pordiosera	CARRO	5	24	5,96
Casona	Patrona	Casero	Perchero	CASA	4	888	6,46
Zapatero	Ganadero	Zapatería	Heladería	ZAPATO	6	17	5,64
Tecleada	Aparcada	Tecleado	Aparcado	TECLA	5	5	5,33
Abusivo	Sorpresivo	Abusona	Cuarentona	ABUSO	5	10	4,47
Velada	Soñada	Velado	Soñado	VELA	4	27	5,71
Milagrero	Curandero	Milagrosa	Olorosa	MILAGRO	7	43	3,11
Balística	Lingüística	Balístico	Lingüístico	BALA	4	11	5,61
Mítico	Caótico	Mítica	Caótica	MITO	4	74	3,11
Poética	Hermética	Poético	Hermético	POESÍA	6	114	5,57
Bañado	Pintado	Bañera	Obrera	BAÑO	4	74	6,35
Maniática	Dinámica	Maniático	Dinámico	MANÍA	5	19	3,87
Labializado	Estudiantado	Labializada	Hospitalizada	LABIO	5	12	6,7
Palabrería	Conserjería	Palabrerío	Caserío	PALABRA	7	255	5,21
Trabajoso	Infeccioso	Trabajosa	Maliciosa	TRABAJO	7	351	5,09
Firmada	Pedida	Firmado	Pedido	FIRMA	5	23	5,91
Añejo	Pendejo	Añeja	Pareja	AÑO	3	332	3,65
Minita	Casita	Minero	Casero	MINA	4	36	5,36
Usuario	Aulario	Usuaria	Agraria	USO	3	126	2,86
Ideología	Patología	Ideólogo	Fisiólogo	IDEA	4	236	3,72
Peligroso	Apestoso	Peligrosa	Apestosa	PELIGRO	7	68	4,47
Pedrada	Granizada	Pedrusco	Negruzco	PIEDRA	6	89	6,21
Cristiano	Anciano	Cristiana	Anciana	CRISTO	6	0	-1
Joyería	Romería	Joyero	Romero	JOYA	4	6	5,96
Frutero	Llavero	Frutera	Soltera	FRUTO	5	28	5,75
Lunática	Simpática	Lunático	Simpático	LUNA	4	80	5,57
Ganadero	Cocinero	Ganadería	Carpintería	GANADO	6	29	5,83
Escénica	Auténtica	Escénico	Auténtico	ESCENA	6	91	4,51
Fiscalizado	Estimulado	Fiscalizada	Estimulada	FISCO	5	1	-1
Peluquería	Genealogía	Peluquero	Hormiguero	PELUCA	6	1	-1
Asqueroso	Belicoso	Asquerosa	Belicosa	ASCO	4	23	5,17
Musiquilla	Lamparilla	Musicalizado	Señalizado	MÚSICA	6	149	5,21
Pasarela	Clientela	Pasillo	Rojillo	PASO	4	289	4,51
Mantilla	Bombilla	Manteo	Acarreo	MANTA	5	24	5,62
Hechicero	Pastelero	Hechicera	Pastelera	HECHIZO	7	4	-1
Flechada	Cansada	Flechazo	Tortazo	FLECHA	6	8	6,15
Pañuelo	Señuelo	Pañoleta	Corneta	PAÑO	4	13	4,87
Palmera	hornera	Palmero	Coletero	PALMA	5	19	6,42
Cursillo	Librillo	Cursada	Apagada	CURSO	5	75	2,8
Vitalicia	Pericia	Vitalicio	Ejercicio	VIDA	4	1147	3,8
Caballero	Jornalero	Caballería	Peluquería	CABALLO	7	94	6,61
Culposa	Odiosa	Culposo	Odioso	CULPA	5	77	3,54
Librito	Cojito	Libreta	Maleta	LIBRO	5	286	6,21
Cabecera	Ranchera	Cabecero	Ranchero	CABEZA	6	418	6,01
Polvoriento	Harapiento	Polvareda	Alameda	POLVO	5	69	5,8
Gallinita	Sonrisita	Gallinero	Curandero	GALLINA	7	19	6,71
Jarrito	Pepito	Jarrita	Pepita	JARRO	5	3	-1
Fantástica	Rústica	Fantástico	Rústico	FANTASÍA	8	40	3,83
Colegiado	Asociado	Colegiada	Asociada	COLEGIO	7	84	-1
				Mean	**5.16**	**111.18**	**4.427**

Appendix 2
Opaque Gender

SAME		DIFFERENT					
Related	**Non related**	**Related**	**Non related**	**TARGET**	**Length**	**Frequency**	**Imaginability**
Lechera	Manera	Lechero	Trastero	LECHE	5	69	6,33
Cafetero	Verdadero	Cafetera	Verdadera	CAFÉ	4	105	5,2
Florita	Pintita	Florito	Dedito	FLOR	4	59	6,25
Cristalero	Hormiguero	Cristalera	Bananera	CRISTAL	7	74	5,69
Ciudadana	Avellana	Ciudadano	Avellano	CIUDAD	6	332	6,19
Lapicero	Embustero	Lapicera	Embustera	LÁPIZ	5	10	5,92
Urbana	Humana	Urbano	Humano	URBE	4	2	-1
Heroico	Plástico	Heroica	Plástica	HÉROE	5	39	5,68
Mujercita	Pobrecita	Mujeriego	Andariego	MUJER	5	668	6,61
Relojero	Basurero	Relojería	Pedantería	RELOJ	5	71	6,04
Cancioncilla	Muletilla	Cancionero	Refranero	CANCIÓN	7	44	5,33
Robótico	Idéntico	Robótica	Idéntica	ROBOT	5	19	6,07
Moralizada	Sintonizada	Moralizado	Sintonizado	MORAL	5	171	2,07
Sonido	Quejido	Sonajera	Lisonjera	SON	3	1449	-1
Cruzada	Pelada	Cruzado	Pelado	CRUZ	4	55	-1
Pececillo	Cuadernillo	Pecera	Casera	PEZ	3	30	6,76
Careta	Paleta	Careo	Pareo	CARA	4	315	6,25
Carbonero	Delantero	Carbonera	Delantera	CARBÓN	6	25	6,06
Tijeritas	Sodomitas	Tijeretazo	Escopetazo	TIJERAS	6	4	6,16
Jaboncito	Hombrecito	Jabonera	Billetera	JABÓN	5	9	5,64
Salada	Dorada	Salado	Dorado	SAL	3	30	6,33
Movilizado	Canonizado	Movilizada	Canonizada	MÓVIL	5	13	4,2
Señalada	Conectada	Señalado	Conectado	SEÑAL	5	75	4,8
Planificado	Sacrificado	Planificada	Sacrificada	PLAN	4	43	3,19
Imaginaria	Solidaria	Imaginario	Solidario	IMAGEN	6	203	4,24
Cartonero	Forastero	Cartonera	Forastera	CARTÓN	6	19	6,6
Gentuza	Caperuza	Gentío	Hastío	GENTE	5	299	6,63
Hambriento	Avariento	Hambrienta	Avarienta	HAMBRE	6	65	5,46
Razonada	Acostada	Razonado	Acostado	RAZÓN	5	275	2,88
Limonero	Altanero	Limonada	Encerada	LIMÓN	5	6	-1
Mentalizada	Humanizada	Mentalizado	Humanizado	MENTE	5	86	2,86
Camionero	Aduanero	Camioneta	Libreta	CAMIÓN	6	13	6,52
Funcionaria	Temeraria	Funcionario	Temerario	FUNCIÓN	7	139	2,83
Alámbrico	Volcánico	Alambrada	Escapada	ALAMBRE	7	7	-1
Carnicería	Abogacía	Carnicero	Manicero	CARNE	5	118	6,22
Farolero	Santero	Farolera	Santera	FAROL	5	9	5,52
Sangría	Alegría	Sanguíneo	Fulmíneo	SANGRE	6	216	6,06
Goleado	Armado	Goleada	Armada	GOL	3	4	-1
Liberada	Asombrada	Liberado	Asombrado	LIBERTAD	8	186	4,94
Papeleo	Muestreo	Papelera	Consejera	PAPEL	5	198	6,34
Reunida	Letrada	Reunido	Letrado	REUNIÓN	7	34	5,25
Gasoducto	Viaducto	Gasolina	Marihuana	GAS	3	40	4,71
Crucificada	Legalizada	Crucificado	Legalizado	CRUCIFIXIÓN	11	5	5,03
Canceroso	Tenebroso	Cancerosa	Tenebrosa	CÁNCER	6	24	4,55
Basada	Calzada	Basado	Calzado	BASE	4	107	3,49
Clonado	Marcado	Clonada	Marcada	CLON	4	1	-1
Virtuosa	Tramposa	Virtuoso	Tramposo	VIRTUD	6	47	3,36
Azucarado	Normalizado	Azucarera	Borrachera	AZÚCAR	6	25	6,5
Cognitiva	Nutritiva	Cognitivo	Nutritivo	COGNICIÓN	9	0	-1
Cosmológico	Etimológico	Cosmografía	Ortografía	COSMOS	6	14	4,56
Confesada	Divertida	Confesado	Divertido	CONFESIÓN	9	16	4,2
Alcohólico	Xenofóbico	Alcohólica	Xenofóbica	ALCOHOL	7	38	6,02
Revolucionaria	Universitaria	Revolucionario	Universitario	REVOLUCIÓN	10	52	4,71
Mensajero	Placentero	Mensajera	Placentera	MENSAJE	7	43	4,35
Religiosa	Bondadosa	Religioso	Bondadoso	RELIGIÓN	8	70	4,23
Jardinero	Carcelero	Jardinera	Carcelera	JARDÍN	6	93	5,86
Conectada	Manchada	Conectado	Manchado	CONEXIÓN	8	16	-1
Marinero	Cocinero	Marítima	Legítima	MAR	3	222	6,2
Cuestionada	Invertida	Cuestionado	Invertido	CUESTIÓN	8	150	3,22
Terrorífico	Pacífico	Terrorífica	Pacífica	TERROR	6	51	4,62
				Mean	**5.65**	**110.03**	**4.26**

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