Doctoral Dissertation

GRAMMATICAL GENDER IN BILINGUAL LANGUAGE SELECTION AND CONTROL

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Introductory Note

The content of this doctoral dissertation has been drawn up according to the regulations of the University of Granada to obtain the International Doctorate Mention in the Psychology Doctoral Program. According to this, the majority of the thesis has been written in English. Specifically, in Chapter I a theoretical introduction to the subject of the investigation is presented in Spanish. Next, Chapter II contains a summary of the theoretical background written in English. Finally, the rest of the empirical chapters (Chapters III to VI) and the general discussion (Chapter VII) proceeds in English.

This thesis aims to explore important aspects of lexical access in monolingual and bilingual speakers through the study of grammatical gender in Romance languages. After reviewing previous empirical data and theoretical approaches in the introductory chapters, in Chapter III we present evidence of how grammatical gender is represented and accessed within the lexical system in Spanish and Italian speakers. This is the basis for studying the interaction of the languages at this level in Italian-

Spanish bilinguals. Thus, in Chapter IV we show that grammatical gender influences bilingual lexical access in gendered languages and leads to between-language competition in L2 spoken-word processing. Then, in Chapter V we explore the transfer of grammatical gender properties from a gendered language (Spanish) to a second language lacking this feature (English); and additionally we evidence that being immersed in an L2 context prevents the influence of the native language at this level. This result parallels the idea that bilinguals must inhibit their L1 to facilitate L2 access. Therefore, in Chapter VI we explore whether Italian-Spanish speakers can inhibit the grammatical gender of their native language while performing a task in L2 and it is a source of competition between languages. Finally, some of the more interesting points which emerge from our studies are considered fully in the general discussion in Chapter VII.

Capítulo 1

Introducción,
estructura y objetivos de la tesis.

Una opinión bien extendida entre la población es que un bilingüe es una persona que habla dos idiomas correctamente, con la misma fluidez y precisión de un hablante nativo. Sin embargo, la realidad es otra, pues la gran mayoría de bilingües no muestra un equilibrio simétrico en las habilidades lingüísticas de cada uno de sus idiomas. Esta visión más *extrema* del bilingüismo está cambiando por otra versión más flexible, y que recoge en su definición la gran variabilidad existente en este tipo de población. Siguiendo la definición que propone Grosjean (2010), bilingües son todas las personas que usan más de un idioma en su vida diaria. De este modo, el énfasis recae en el uso, y otros factores como puedan ser el nivel de fluidez, el historial lingüístico, o el contexto principal de uso, pasan a ser características definitorias de la experiencia bilingüe.

Siguiendo esta definición, una cuestión importante en el estudio del bilingüismo pasa por investigar cómo están representados en el léxico mental los distintos idiomas que habla una persona

bilingüe, ya que la gran mayoría de estudios demuestra que los bilingües activan ambas lenguas de manera simultánea, incluso cuando solo usan una de ellas (para una revisión véase, Dijkstra, 2005; Kroll, Dussias, Bogulski, & Valdés, 2012). Esto significa que, entre otras, las propiedades gramaticales o fonológicas de un idioma influyen sobre el procesamiento de la otra lengua. En este sentido, nuestro trabajo de investigación se centrará de manera específica en el estudio del género gramatical: una propiedad léxica intrínseca a los nombres existente en muchas lenguas (Corbett, 1991). De este modo, abordaremos el estudio del género gramatical tanto en población monolingüe como en población bilingüe, estructurando la introducción de la siguiente forma.

En el primer apartado de la introducción describiremos cómo se produce el acceso a las palabras que tenemos almacenadas en nuestro *vocabulario mental* (esto es, el proceso de acceso léxico) según los principales modelos de producción lingüística (Caramazza, 1997; Levelt, Roelofs, & Meyer, 1999). A pesar de existir diferencias entre ellos, estos modelos comparten la idea de que el acceso al léxico comprende una serie de fases que empieza con la selección de una palabra semánticamente apropiada al mensaje que se quiere transmitir, la recuperación de sus propiedades sintácticas y fonológicas, la rápida silabificación de la palabra dentro de su contexto, y, finalmente, la preparación de los correspondientes gestos articularios que permiten su expresión. Seguidamente, nos centraremos en describir cómo estos modelos explican el proceso de activación y selección del género gramatical, una de las propiedades de los nombres que, quizás por su arbitrariedad de asignación, es de las más complejas de adquirir al aprender una lengua.

En el siguiente apartado de la introducción profundizaremos sobre cómo están representados los idiomas y cómo se produce el acceso léxico en el caso de los hablantes bilingües. Presentaremos parte de la evidencia que demuestra cómo las personas bilingües activan las dos lenguas de manera simultánea y cómo las propiedades de ambos sistemas léxicos interactúan entre sí (Dijkstra, 2005). Comprobaremos hasta qué punto las propiedades fonológicas o sintácticas de un idioma influyen sobre el procesamiento y acceso de las representaciones lingüísticas del otro. En este sentido, describiremos la interacción que se produce entre los idiomas a raíz de la activación simultánea de lenguas en bilingües. A continuación, volveremos a centrarnos de manera específica en la información de género gramatical. En este caso explicaremos cómo esta propiedad interacciona entre los idiomas, esto es, cómo el género gramatical del primer idioma influye en el acceso léxico y procesamiento lingüístico de la segunda lengua.

En el último apartado de la introducción presentaremos los principales modelos de selección de idiomas en bilingües, que explican cómo los hablantes de varias lenguas son capaces de resolver la interferencia generada por la activación paralela de idiomas y, así, seleccionar en última instancia el idioma deseado y las entradas léxicas más apropiadas según el contexto y las intenciones del hablante (Costa & Caramazza, 1999; Dijkstra & van Heuven, 1998; Green, 1998; Meuter & Allport, 1999; Poulisse & Bongaerts, 1994). Haremos hincapié, sobre todo, en el papel que ejercen los procesos ejecutivos de tipo inhibitorio sobre el control de idiomas en bilingües. Según estos, la interferencia causada por la coactivación de lenguas se resuelve por medio de la supresión de palabras o idiomas que compiten durante el

procesamiento, lo que se traduce en una mayor dificultad a la hora de reactivar la información inhibida (Green, 1998; Meuter & Allport, 1999). En nuestro caso, volveremos a centrarnos en el estudio del género gramatical para determinar si la interferencia producida por la coactivación de idiomas a este nivel es resuelta por estos mecanismos de control inhibitorio. Además, discutiremos el papel que puede jugar la inmersión lingüística en esta serie de procesos, es decir, cómo el hecho de vivir en un país de lengua extranjera influye en el acceso léxico del idioma nativo, y cómo este proceso puede facilitar el proceso de aprendizaje de una segunda lengua.

El conjunto de estudios que conforman nuestra serie experimental irá destinado a cubrir las preguntas de investigación que formularemos en los distintos apartados de la introducción. De este modo, a lo largo de la introducción iremos dando coherencia a los experimentos que presentaremos en nuestro trabajo. No obstante, una última sección de la introducción resumirá, de manera específica, la organización, estructura y objetivos de toda la serie experimental.

ACCESO LÉXICO EN LA PRODUCCIÓN LINGÜÍSTICA

¿Cómo conseguimos las personas acceder a nuestro vocabulario mental y generar palabras durante el discurso? En una conversación normal, los adultos producimos entre dos y tres palabras de media por segundo, las cuales escogemos de un vocabulario mental que contiene un total de entre 50.000 y 100.000 palabras (Miller, 1991). El acceso léxico se define como el proceso cognitivo que implica no solo la activación y búsqueda de palabras en nuestro diccionario mental, sino también su

recuperación de entre todas las representaciones internas que tenemos almacenadas en nuestra lengua (ya sea una o varias). Cada una de estas unidades léxicas tiene almacenadas diferentes características y propiedades, como puede ser la información semántica, las propiedades gramaticales, y las características ortográficas, entre otras. En concreto, los principales modelos de producción lingüística asumen la existencia de tres niveles diferentes de representación (Caramazza, 1997; Dell, 1986; Levelt et al., 1999; Levelt, 1989): (i) una representación conceptual no verbal en la que se almacena la información semántica de la palabra; (ii) una representación léxica en la que aparecen las propiedades sintáctico-gramaticales de la palabra; y (iii) una última representación fonológica necesaria para conectar la palabra a su sonido y articulación final.

La producción lingüística comienza con la *activación* de la representación conceptual, es decir, el concepto que el hablante quiere emitir, y fluye a través del resto de niveles hasta la *selección* de fonemas y la programación motora y articulatoria correspondiente. Pero, ¿en qué consiste el proceso de activación léxica y qué lo diferencia del proceso de selección léxica? Para diferenciar entre ambos procesos, veamos el siguiente ejemplo (Figura 1). Si pedimos a una persona que nombre el dibujo de una *manzana*, no solo se activará la entrada léxica correspondiente a dicha palabra, sino también otros conceptos relacionados con ésta (p.ej. *naranja* o *pera*). La activación de estos conceptos relacionados se propagará hasta sus correspondientes entradas léxicas, y también hasta sus representaciones fonológicas. Esta activación de candidatos léxicos es lo que define, principalmente, el proceso de activación léxica. La activación de múltiples entradas léxicas hará que el

sistema tenga que seleccionar, de entre todas ellas, la entrada que más se adecue a la intención del hablante. Esta última fase, en la que finalmente se debe escoger la entrada más apropiada y desechar el resto de candidatos activos, es lo que define el proceso de selección léxica. Aunque existen diferentes posturas a la hora de explicar cómo se produce la selección léxica, todas ellas proponen que este proceso es sensible al grado de activación de los nodos léxicos implicados (La Heij, 2005). De este modo, el nodo que finalmente reciba más activación, será el seleccionado y producido por el hablante.

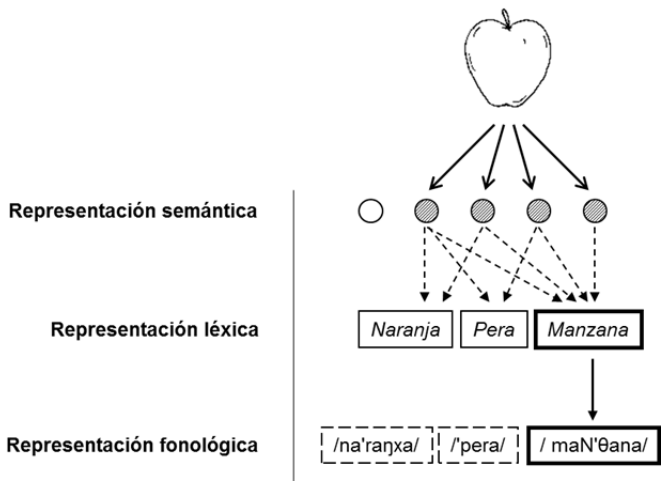

Figura 1 | *Esquema general de los diferentes niveles de representación. Las flechas indican el flujo de activación, y el grosor el nivel de activación de cada representación.*

La concepción de esta organización jerárquica basada en niveles de representación proviene de estudios cronométricos en los que se emplean paradigmas de interferencia, en concreto, el paradigma de interferencia dibujo-palabra (Rosinski, Michnick-Golinkoff, & Kukish, 1975). En esta tarea se registra el tiempo

que los participantes tardan en nombrar un dibujo –estímulo objetivo– que aparece junto a una palabra distractora que deben ignorar –estímulo saliente e interferente–. Esto lo convierte en un paradigma muy útil para investigar procesos de acceso y selección léxica, ya que el proceso de denominación del dibujo se ve interferido por el proceso automatizado de leer una palabra escrita. Por tanto, manipulando la relación entre la palabra escrita y el dibujo objetivo podremos conseguir una información muy valiosa para saber cómo están almacenadas y representadas las palabras en nuestro léxico mental (ver Figura 2).

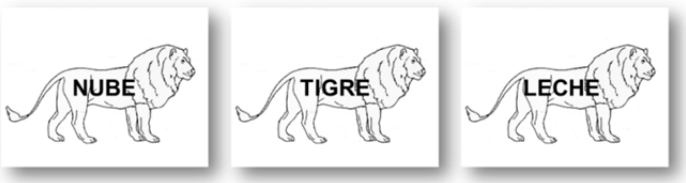

Figura 2 | *Ejemplo del paradigma de interferencia dibujo-palabra en una condición de no relación (izquierda), de relación semántica (centro), y de relación ortográfica-fonológica (derecha).*

Con los primeros estudios de esta tradición experimental se ha comprobado que la existencia de relación semántica entre el dibujo objetivo y la palabra distractora (p.ej. LEÓN-tigre[1]) produce tiempos de respuesta más lentos y un mayor número de errores que cuando ambos estímulos no están relacionados semánticamente (p.ej. LEÓN-aguja; Lupker, 1979; Schriefers, Meyer, & Levelt, 1990). Este efecto puede ser explicado en términos de competición entre los nodos léxicos más activos, los

[1] En la introducción, para referirnos a los estímulos de la tarea de interferencia dibujo-palabra usaremos letra mayúscula para indicar el nombre del dibujo, y letra minúscula para representar la palabra distractora.

cuales compiten entre sí por su recuperación y selección (Caramazza, 1997; Levelt et al., 1999; Roelofs, 1992; pero ver Mahon, Costa, Peterson, Vargas, & Caramazza, 2007). Por ejemplo, al nombrar el dibujo de un *león*, se produce la activación de conceptos relacionados y de sus correspondientes entradas léxicas (p.ej. *tigre* o *leopardo*). Esta activación de competidores dificulta la selección léxica, y los tiempos de respuesta, en consecuencia, son mayores. Si, además, junto al dibujo de *león* presentamos la –ya activada– palabra distractora *tigre*, la selección léxica se vuelve aún más compleja. Esto es así porque la palabra distractora recibe activación de dos fuentes distintas, es decir, de la propia palabra escrita, y de la representación conceptual del dibujo, con la cual comparte rasgos semánticos. Esta activación adicional aumenta la saliencia de la palabra distractora y genera más interferencia con el nombrado del dibujo en comparación a cuando no existe relación semántica entre los miembros del par.

Con el origen de esta corriente experimental también se ha comprobado que el patrón de resultados es el opuesto, es decir, tiempos de denominación más rápidos, cuando el nombre del dibujo y la palabra distractora comparten rasgos fonológicos (p.ej. LEÓN-leche; Lupker, 1982). En este caso, la activación de la palabra distractora hace que también se active su representación fonológica y ortográfica. Por tanto, el hecho de que la palabra distractora comparta algunos de estos segmentos con el nombre del dibujo hace que éste último se encuentre más activo y, por tanto, sea más accesible a la hora de seleccionarlo para su producción (Schriefers et al., 1990).

La novedad de manipular el tiempo que transcurre entre la presentación del dibujo y el distractor, o presentar este último de manera auditiva en lugar de forma escrita, convirtió a este paradigma en una valiosa herramienta para estudiar el curso temporal del acceso léxico, de la codificación semántica y de la codificación fonológica en el estudio de la producción lingüística (Glaser & Düngelhoff, 1984; Schriefers et al., 1990).

Además de la información semántica y fonológica, existe una propiedad adicional de los nombres que también juega un papel importante en el acceso léxico y en la producción lingüística monolingüe: se trata del género gramatical (Bates, Devescovi, Pizzamiglio, D'Amico, & Hernández, 1995; Bentrovato, Devescovi, D'Amico, & Bates, 1999; Grosjean, Dommergues, Cornu, Guillelmon, & Besson, 1994). Sin embargo, la forma en la que está representada y almacenada esta información en el léxico mental, así como el proceso por el cual accedemos y seleccionamos el género gramatical de las palabras es aún un tema sujeto a debate. Por ello, en el siguiente apartado revisaremos las propuestas de los principales modelos de producción lingüística acerca del nivel de representación en que se almacena esta información, y cómo se activa y selecciona el género gramatical en las palabras que pretendemos producir en nuestro discurso.

El Género Gramatical en la Producción Lingüística Monolingüe

El género gramatical es una propiedad intrínseca de los nombres existente en muchas lenguas y que permite clasificarlos en diferentes categorías según las modificaciones que requieren en

palabras asociadas sintácticamente a ellos (Corbett, 1991). Aunque hay idiomas que carecen de esta representación gramatical (como, por ejemplo, el inglés), en la mayoría de idiomas con sistemas léxicos basados en género las categorías más comunes son el masculino, el femenino y el neutro. Por ejemplo, el español, francés o italiano son lenguas romances con un sistema de género basado en dos categorías (masculino y femenino); otros idiomas como el holandés, alemán o ruso cuentan con una categoría de género adicional (neutro); e incluso hay lenguas, como el swahili, formadas por seis posibles valores de género (Corbett, 1991). Los tipos de *género* se han divido, tradicionalmente, en dos categorías: natural y gramatical. El género natural define algunas de las propiedades semánticas asociadas a los nombres, por lo que éste se asigna en función del significado de la palabra, como es el caso del sexo (p.ej. *abuelo* o *abuela*). Por ejemplo, la lengua tamil, del sur de la India, posee un sistema de género estrictamente semántico con tres valores posibles (racional masculino, racional femenino, y no racional). El género de tipo gramatical, por su parte, se atribuye en función de algunas partes de la palabra, o incluso a través de la vocal final de la palabra. En este último caso, no solo los nombres o sustantivos cuentan con este tipo de información, sino que otro tipo de palabras, como verbos, artículos, adjetivos o pronombres, aunque no tienen género per se, sí que lo reflejan en función de su morfología (p.ej. en la oración "la_{FEM} $caja_{FEM}$ *es* $roja_{FEM}$", tanto el artículo como el adjetivo deben ser femeninos para conseguir el acuerdo gramatical con el sustantivo principal).

En nuestro trabajo de investigación nos centraremos, exclusivamente, en el género de tipo gramatical. En los siguientes párrafos, por tanto, profundizaremos en cómo se representa esta

información a nivel léxico y cómo somos capaces de acceder a su representación de manera adecuada durante la producción lingüística.

Siguiendo la propuesta de los sistemas jerarquizados de niveles y representaciones que acabamos de presentar en el apartado anterior, la mayoría de modelos psicolingüísticos postulan que la información de género está representada como una propiedad de los nombres en un nivel independiente de aquellos que especifican la información conceptual y fonológica de la palabra (Caramazza & Miozzo, 1997; Caramazza, 1997; Levelt et al., 1999; Levelt, 1989; Roelofs, 1992). Aunque estos modelos representan el género como un único nodo conectado a todos los nombres pertenecientes a la misma categoría sintáctica (p.ej. masculino o femenino en el caso del español), difieren a la hora de explicar cómo se activa y selecciona la información de género gramatical en el proceso de acceso léxico. Por un lado, se ha propuesto que la activación del género gramatical se produce únicamente tras la activación de la representación léxico-fonológica (Caramazza & Miozzo, 1997), o bien que ocurre de manera previa a la selección fonológica (Cubelli, Lotto, Paolieri, Girelli, & Job, 2005; Levelt et al., 1999; Paolieri, Lotto, Leoncini, Cubelli, & Job, 2011). Por otro lado, en términos de selección de género, algunos autores asumen que el género gramatical se selecciona únicamente en contextos frasales o de sintagma nominal, es decir, cuando se requiere el acceso obligatorio a la información de género para conseguir el acuerdo gramatical entre los diferentes elementos de una oración (Caramazza & Miozzo, 1997; Levelt et al., 1999). Por el contrario, otros autores defienden que la selección ocurre incluso durante la producción de nombres aislados, esto es, cuando el acceso al género gramatical no es requerido por el

contexto de la oración o de la frase (Cubelli et al., 2005; Paolieri et al., 2011).

Uno de los modelos pioneros de producción lingüística representaba la información de género como una propiedad intrínseca de todos los nombres (ver Figura 3; Levelt & Schriefers, 1987; Levelt, 1989). Este modelo diferenciaba entre dos niveles principales de representación: lema y lexema (Kempen & Huijbers, 1983). El primero agrupaba la información conceptual y semántica de la palabra, así como toda la información sintáctica asociada a ella. Por tanto, el género gramatical estaría almacenado en esta representación. El nivel de lexema, por su parte, incluía la forma fonológica y morfológica de la palabra. Por tanto, según este modelo, el género gramatical es una propiedad intrínseca de todos los nombres, y no se trata de un nodo independiente y separado de ellos.

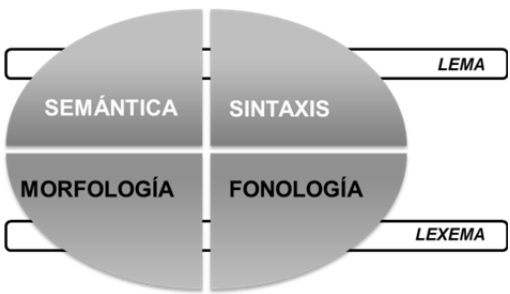

Figura 3 | *Modelo original de Levelt y colaboradores (Levelt & Schriefers, 1987; Levelt, 1989).*

Basado en él surgió el modelo *WEAVER++* (***W****ord-form* ***E****ncoding by* ***A****ctivaction and* ***VER****ification*), también propuesto por Levelt y colaboradores (Levelt et al., 1999; Roelofs, 1992), y en el cual ahora las propiedades sintácticas de los nombres –entre ellas el género gramatical– pasan de ser una propiedad intrínseca

de los nombres a una propiedad almacenada en forma de nodos independientes, pero conectados con cada representación léxica (ver Figura 4). En este modelo, cada representación léxica (de carácter abstracto) también recibe el nombre de lema, y media entre el nivel conceptual y el nivel fonológico.

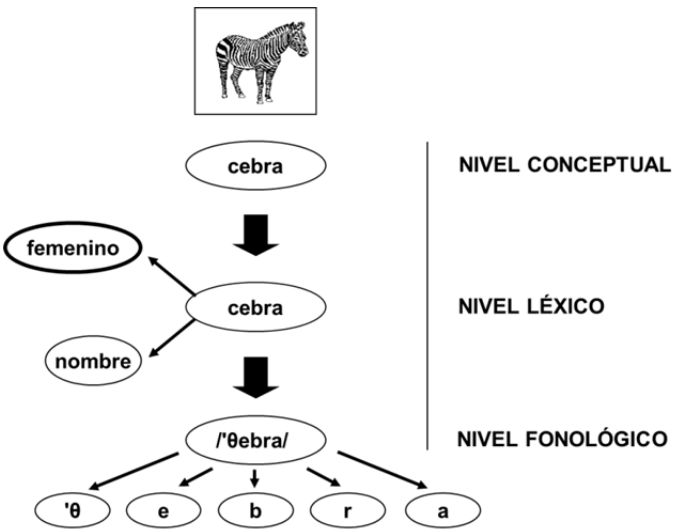

Figura 4 | *Modelo WEAVER++ (adaptado de Levelt et al., 1999; Roelofs, 1992).*

Un aspecto importante de este modelo es que la representación fonológica de la palabra se selecciona, únicamente, una vez que el lema ha sido seleccionado. Sin embargo, la selección del lema no conlleva, necesariamente, la selección de sus propiedades sintácticas. En su lugar, los autores proponen que estas propiedades se activan tras la selección del lema, pero su selección ocurre únicamente cuando se precisa el acceso a dicha información. Esto ocurre, por ejemplo, cuando se requiere el acuerdo gramatical entre diferentes elementos de una oración (p.ej., en la oración "*el*$_{MAS}$ *león*$_{MAS}$ *estaba hambriento*$_{MAS}$", ya que

se requiere que todos los elementos de la oración sean de género masculino para que exista acuerdo gramatical). Por el contrario, en la producción de un nombre aislado, en cuyo caso no se precisa el acceso a la información de género, la información gramatical estaría activada pero no seleccionada.

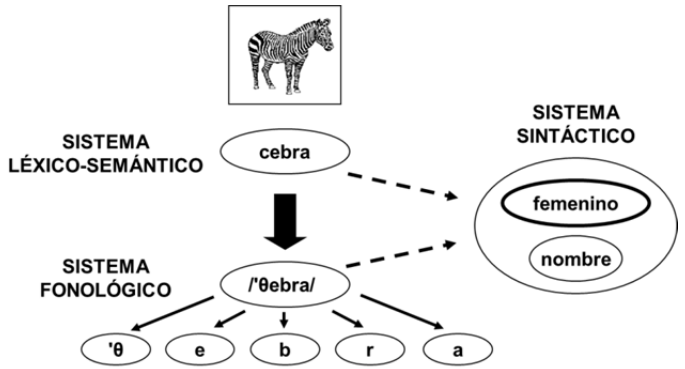

Figura 5 | *Modelo IN (Caramazza, 1997).*

Por su parte, el modelo IN (***I**ndependent **N**etwork*), propuesto por Caramazza y Miozzo (Caramazza & Miozzo, 1997; Caramazza, 1997), plantea un modelo alternativo en el cual la representación conceptual activa directamente tanto la representación fonológica de la palabra como sus propiedades léxico-semánticas, de manera paralela (ver Figura 5). Por tanto, según este modelo no es necesario el paso por el nivel léxico para activar la forma fonológica de la palabra, siendo la selección del género gramatical un proceso automático que sigue a la activación de este último nodo. Así, la representación semántica se relacionaría de manera directa con la forma de la palabra, representada a nivel fonológico, y también activaría de manera paralela las características sintácticas que tienen importancia a nivel semántico (como, por ejemplo, el tiempo verbal y el número). Sin

embargo, esta activación parcial no sería suficiente para seleccionar tales características, y su selección solo sería posible a través del nivel fonológico de la palabra. Para este modelo, entonces, la selección del género gramatical se entiende como un proceso automático, no competitivo, y que sigue a la selección de la forma fonológica de la palabra.

En resumen, los dos modelos comparten la noción de que los hablantes pueden acceder a la forma fonológica de una palabra sin seleccionar su género gramatical, dado que ambos proponen que la selección del género se produce únicamente en casos donde se requiere el acceso a dicha información. Esto se produce, por ejemplo, cuando los hablantes tienen que producir palabras dentro de una frase en la que se requiere el acuerdo de género gramatical entre los distintos elementos que la componen. Desde el punto de vista experimental, podemos predecir que los participantes deben acceder a la información de género gramatical cuando tienen que nombrar, por ejemplo, dibujos junto a su artículo correspondiente, o producir el nombre de un dibujo junto a un adjetivo, ya que ambos son elementos que deben concordar en género con el nombre del dibujo (p.ej. *la*$_{FEM}$ *casa*$_{FEM}$ *pequeña*$_{FEM}$). De manera opuesta, cuando no se precisa un acuerdo sintáctico entre los elementos de una frase y, por tanto, no se requiere acceder al género, la producción se llevaría a cabo sin la selección del género gramatical. Esto ocurre, por ejemplo, en una tarea en la que pedimos a los participantes nombrar un dibujo de manera aislada (p.ej. "casa"), sin ningún otro elemento que deba concordar en género con el nombre del dibujo.

Por tanto, una buena aproximación a la hora de comprobar estas predicciones pasa por el uso de la tarea de interferencia dibujo-

palabra. En este caso, manipulando la congruencia de género entre el nombre del dibujo y la palabra distractora podemos comprobar cuál es el papel que ejerce el género gramatical en el acceso al léxico. En una serie de estudios llevados a cabo con nativo hablantes de alemán y holandés, los autores manipularon la relación de género entre el dibujo y la palabra (La Heij, Mak, Sander, & Willeboordse, 1998; Schriefers & Teruel, 2000; Schriefers, 1993). Los participantes tenían que producir el nombre del dibujo usando el artículo correspondiente y/o un adjetivo. Tanto en alemán como en holandés los artículos y los adjetivos están marcados por el género, de manera que es necesario acceder a dicha representación gramatical para poder realizar la tarea correctamente. Por ejemplo, en alemán existe el artículo definido *der, die* y *das* para el femenino, masculino y neutro, respectivamente; mientras que en holandés existe *de* para el masculino y el femenino, y el artículo *het* para el neutro. Los resultados demostraron que los participantes eran más rápidos nombrando cuando el nombre del dibujo y la palabra distractora compartían género gramatical que cuando ambos eran diferentes. Por el contrario, en estos dos idiomas, los nombres –de manera aislada– no están marcados por el género, sino que esta información, como acabamos de decir, queda definida únicamente por el artículo o por el adjetivo que lo acompaña. Por ejemplo, el género de la palabra *silla* en holandés *(stoel)* está determinado solamente por el artículo definido *(de stoel)* o por el sufijo del adjetivo que lo acompaña *(groene stoel,* silla verde*)*. Por tanto, según la predicción que acabamos de hacer, el efecto de género debería desaparecer al pedir a los participantes que nombren los dibujos de manera aislada. Los resultados de un conjunto de estudios confirmaron esta hipótesis (La Heij et al., 1998; Schriefers, Jescheniak, & Hantsch, 2005; Starreveld & La

Heij, 2004) y demostraron que cuando los participantes tenían que producir de manera aislada el nombre del dibujo, y, por tanto, acceder a la información de género era prescindible, el efecto de género desaparecía. Según este conjunto de resultados, se ha interpretado que la información de género se selecciona únicamente cuando es necesaria en el contexto sintáctico del nombre. La ausencia de la influencia del género en la producción de nombres aislados se explica asumiendo que el género del nombre no juega un papel determinante en la selección de la representación fonológica de una palabra.

No obstante, la evidencia experimental parece no ser tan clara en este aspecto. Por un lado, Schiller y Caramazza (2002) observaron que el efecto de género en lenguas germanas desaparecía al usar el plural del determinante (es importante recordar que en estas lenguas solo hay una única forma de determinante para el plural, pero varias formas para el singular). Por ello, estos autores sugieren que el efecto de género en estos idiomas se origina en la selección del determinante, y no en la selección específica de la representación de género de los nombres. Por otro lado, un conjunto de estudios posteriores ha demostrado que el efecto de género tiene un patrón de resultados diferente dependiendo de las características de los idiomas en los cuales se estudia (para una revisión véase, Caramazza, Miozzo, Costa, Schiller, & Alario, 2001), por lo que los resultados de los experimentos que acabamos de presentar podrían estar restringidos a los idiomas usados en ellos, esto es, lenguas germánicas. Por ejemplo, en italiano, Miozzo y Caramazza (1999) no encontraron ningún efecto de género en una tarea de producción de sintagmas nominales (artículo + nombre) en la que, supuestamente, se requiere el acuerdo gramatical entre

ambos elementos y el acceso al género es imprescindible. Alario y Caramazza (2002) tampoco encontraron este efecto en francés cuando los participantes tenían que nombrar los dibujos en una forma simple (artículo + nombre) o compleja (artículo + adjetivo + nombre). Por último, Costa y colaboradores también fallaron a la hora de replicar este efecto en español y catalán (Costa, Sebastián-Gallés, Miozzo, & Caramazza, 1999). Entonces, ¿por qué estos autores no encontraron influencia del género si en todos los casos se requería acceder a dicha información? Este patrón de resultados, todos ellos con lenguas romances, es difícil de explicar por los modelos revisados anteriormente (Caramazza, 1997; Levelt et al., 1999), ya que ambos predecían un claro efecto del género siempre y cuando la tarea requiriese acceso a dicha información. Todos estos autores coinciden en señalar que la inconsistencia con respecto a los experimentos llevados a cabo en holandés y alemán (La Heij et al., 1998; Starreveld & La Heij, 2004) reflejan diferencias en cuanto al proceso de acceso léxico en idiomas romances y germánicos, y que cuando se trata de tareas en las que se requiere el acceso al género (artículo/adjetivo + nombre), el efecto aparece en lenguas germánicas (p.ej. holandés y alemán) pero no en lenguas romances (p.ej. italiano, español, francés o catalán).

En este sentido, con el objetivo de explicar esta inconsistencia, Miozzo y Caramazza (1999) propusieron la distinción entre idiomas de selección temprana e idiomas de selección tardía. En los primeros, como el holandés y el alemán, la selección del artículo determinado, que denota la propiedad de género, depende única y exclusivamente del género del nombre. Por el contrario, en los segundos, como el italiano o francés, esta selección depende no solo de la información sintáctica del

nombre, sino también de sus características fonológicas. Por ejemplo, en italiano el artículo singular masculino es *lo* siempre que la siguiente palabra comience por una vocal o por las consonantes *z-, gn-, ps-,* o *s-* seguida de otra consonante. En el resto de casos, el artículo masculino siempre es *il*. Siendo así, podemos esperar que en idiomas de selección tardía, como el italiano, no se observe efecto de congruencia de género en tareas de producción de sintagmas nominales, ya que la selección del artículo depende de la recuperación previa de la forma fonológica de la palabra. En consecuencia, la selección del artículo ocurre muy tarde en el proceso de producción lingüística y, por tanto, es posible que la influencia del género a la hora de nombrar el dibujo desaparezca o quede enmascarada. En idiomas germánicos, por el contrario, la selección del artículo no depende de las propiedades fonológicas de la palabra, por lo que ocurre antes en el proceso de producción y el efecto de interferencia de género es observable en este tipo de tareas.

En consistencia con esta hipótesis, estudios recientes realizados en italiano han vuelto a no encontrar ninguna influencia del género de la palabra distractora cuando pedían a los participantes nombrar el dibujo junto a su artículo correspondiente (Cubelli et al., 2005; Paolieri et al., 2011). Sin embargo, los autores también pidieron a los participantes que nombraran los dibujos de manera aislada, esto es, sin producir ningún artículo o adjetivo marcado por el género. En este caso, los resultados mostraron un claro efecto de congruencia de género: los participantes fueron más lentos cuando el nombre del dibujo objetivo y la palabra distractora compartían género gramatical. Para explicar esta inconsistencia con respecto a los resultados encontrados en producción de nombres aislados en idiomas germánicos (La Heij

et al., 1998; Schriefers et al., 2005; Starreveld & La Heij, 2004), los autores sostienen que el efecto de género depende de las propiedades morfosintácticas de cada idioma. En italiano, por ejemplo, la mayoría de los nombres terminados en *–a* denotan género femenino (p.ej. *sciarpa*$_{FEM}$ o *finestra*$_{FEM}$, bufanda y ventana, respectivamente), mientras que aquellos terminados en *–o* indican género masculino (p.ej. *sedano*$_{MAS}$ o *rubinetto*$_{MAS}$, apio y grifo, respectivamente). Esta terminación de los nombres, que está morfológicamente marcada por el género, se llama terminación transparente. Además, otros muchos nombres cuentan con terminación *–e* (p.ej. *chiave*$_{FEM}$ o *pettine*$_{MAS}$, llave y peine, respectivamente), la cual es una marca morfológica no marcada por el género y que, por tanto, recibe el nombre de terminación opaca. Esto significa que la información de género tiene que ser recuperada en un nivel de representación previo al acceso de la forma final de cada palabra (Cubelli et al., 2005). Tal y como hemos dicho, los nombres en holandés y alemán no tienen marca morfológica para el género, lo que explicaría por qué el efecto en producción de nombres aislados se observa en lenguas romances pero no en lenguas germánicas. En conclusión, Cubelli y colaboradores (2005) sostienen que la información de género está almacenada en la representación léxica, y que la selección de esta propiedad gramatical es un proceso competitivo que sigue a la selección de la representación conceptual, y que precede al acceso de la forma fonológica de la palabra.

El efecto de congruencia de género se puede explicar en términos de competición entre nodos léxicos activos, es decir, por la interferencia que genera la palabra distractora sobre el acceso al nombre del dibujo. Debido al formato ortográfico de la palabra, el nivel de activación alcanzado por ésta es mayor en

comparación con la entrada léxica correspondiente al nombre del dibujo (Cubelli & Paolieri, 2008). Esto obliga la puesta en marcha de mecanismos que supriman su activación, y, en consecuencia, los tiempos de respuesta son más lentos. De manera adicional, el hecho de que ambos estímulos compartan género gramatical, hace que la interferencia sea aún mayor y, por tanto, los tiempos de nombrado sean aún más lentos que cuando el nombre del dibujo y la palabra no comparten género entre sí. En este sentido, de manera similar a la competición generada cuando el nombre del dibujo y la palabra distractora comparten rasgos semánticos (Schriefers et al., 1990), podríamos suponer que el hecho de que ambos estímulos compartan rasgos gramaticales provoque una competición adicional a la hora de seleccionar la entrada léxica correspondiente al nombre del dibujo. En consecuencia, los tiempos de denominación en la condición de congruencia de género se verían enlentecidos (Cubelli et al., 2005).

El español es un idioma romance con un sistema de género parecido al italiano y sintácticamente similar. Al igual que en éste, la mayoría de nombres terminados en *–a* denotan género femenino (p.ej. *casa*$_{FEM}$ o *montaña*$_{FEM}$), mientras que aquellos que lo hacen en *–o* indican género masculino (p.ej. *escritorio*$_{MAS}$ o *plátano*$_{MAS}$). También existe la terminación opaca de género *–e* para los nombres (p.ej. *llave*$_{FEM}$ o *timbre*$_{MAS}$), y un pequeño número de terminaciones irregulares que no cumplen estos criterios (p.ej. *gorila,* con terminación *–a* pero de género masculino, o *mano,* con terminación *–o* pero de género femenino). Por esta razón, el género gramatical en español e italiano debería comportarse de manera similar en lo que se refiere a procesos de acceso y selección léxica. Siendo así, esperamos encontrar los mismos resultados observados por

Cubelli y colaboradores (Cubelli et al., 2005; Paolieri et al., 2011) ante una tarea de producción de nombres aislados en español. El capítulo III incluirá dos experimentos dirigidos a comprobar esta predicción. Por tanto, participantes nativo hablantes de italiano y español tendrán que completar una tarea de interferencia dibujo-palabra en la que manipularemos la congruencia de género entre ambos estímulos. La predicción es que en ambos idiomas los participantes deben ser más lentos cuando los dos estímulos compartan género gramatical. Esto aportará nueva evidencia respecto a si el género gramatical es una propiedad almacenada a nivel léxico y si ésta es recuperada siempre y cuando ocurra el acceso léxico a este nivel. Pero no solo eso, sino que estos resultados nos proporcionarán también una información muy valiosa para responder a nuestra siguiente pregunta. Dado que parte de nuestra investigación se dirige a estudiar el papel que ejerce el género gramatical en el acceso léxico en bilingües italiano-español, y la evidencia apunta a que el parecido entre el sistema de género de cada idioma juega un papel importante (Sabourin, Stowe, & de Haan, 2006), estos dos primeros experimentos sentarán las bases para poder estudiar estos procesos en bilingües de estos dos idiomas.

En este sentido, una pregunta que ha generado mucho interés en el campo de la psicolingüística y del bilingüismo es cómo están estructurados los diferentes sistemas léxicos que habla una persona bilingüe. El siguiente apartado de la introducción tratará de profundizar en cómo se produce la activación de idiomas en bilingües, cómo ocurre el flujo de activación entre los diferentes niveles de representación y cómo se lleva a cabo, finalmente, la selección léxica. Una vez tratado este tema, nos centramos de

nuevo en cómo la información de género gramatical se estructura y afecta a estos procesos en la población bilingüe.

ACCESO LÉXICO EN BILINGÜES

Cuando pedimos a una persona que nombre un objeto, lo primero que tiene que hacer es recuperar su representación conceptual de la memoria, de cara a poder seleccionar la entrada léxica correspondiente y, así, acceder a su forma fonológica (Caramazza, 1997; Levelt et al., 1999). La mayoría de modelos de acceso léxico en bilingües asumen la existencia de un sistema semántico compartido por los dos idiomas (Costa, Miozzo, & Caramazza, 1999; de Bot, 1992; Kroll & Stewart, 1994; Poulisse & Bongaerts, 1994). En consecuencia, en personas bilingües el acceso léxico se convierte en un proceso más costoso, ya que la selección del concepto sirve para activar dos entradas léxicas diferenciadas, una para cada idioma. En comparación con los monolingües, los bilingües son, por tanto, más lentos nombrando dibujos, aunque no difieren en cuanto a la rapidez en la que acceden a la información semántica de las palabras (Gollan, Montoya, Fennema-Notestine, & Morris, 2005). Una posibilidad es que el proceso de producción y comprensión cuando se domina en más de una lengua se convierta en una tarea competitiva. En este sentido, numerosas investigaciones han centrado sus esfuerzos en determinar cómo las representaciones léxicas de un segundo idioma (de aquí en adelante L2) se relacionan y pueden verse afectadas por la influencia de las representaciones léxicas del idioma nativo (L1) (Kroll & de Groot, 2005).

Por un lado, desde una perspectiva de acceso léxico selectivo, se propone que la activación de una entrada conceptual afecta, únicamente, a la activación de la entrada léxica correspondiente al idioma deseado (Gerard & Scarborough, 1989; Scarborough, Gerard, & Cortese, 1984). En este caso, la selección léxica debería ocurrir de la misma manera que en los hablantes monolingües, ya que la lengua alternativa no estaría activada. En uno de estos experimentos, los autores pidieron a participantes bilingües que completaran una tarea de decisión léxica. En esta tarea se presentan una serie de caracteres, y los participantes deben decidir si esta cadena de letras corresponde a una palabra real o no. En este tipo de tareas se suelen emplear palabras reales, palabras no reales, y pseduopalabras, esto es, palabras articulables en un idioma pero que carecen de significado. En la condición de pseudopalabras, los autores introdujeron palabras existentes en el idioma alternativo de los participantes. Los resultados demostraron que estas palabras eran rechazadas con la misma rapidez que el resto de pseudopalabras. Por tanto, los autores concluyeron que las personas bilingües activan únicamente el idioma relevante para la tarea, lo que apoya esta visión selectiva de activación de idiomas en bilingües.

Sin embargo, estudios posteriores no han conseguido replicar tales hallazgos, encontrando un patrón de acceso al léxico no selectivo (Dijkstra, Grainger, & van Heuven, 1999; van Heuven, Schriefers, Dijkstra, & Hagoort, 2008). En uno estos estudios, participantes bilingües de holandés-inglés tenían que realizar una tarea de decisión léxica en L2, en la que los autores emplearon palabras con distinto grado de similitud ortográfica y fonológica con respecto a las traducciones a L1. Los resultados demostraron que los participantes fueron más rápidos respondiendo ante

palabras con alto parecido ortográfico, pero más lentos ante palabras relacionadas fonológicamente, demostrando que el idioma nativo estaba activo e influyendo en el procesamiento de L2 (Dijkstra et al., 1999).

En este sentido, la mayor parte de evidencia experimental apunta a que la activación desde el sistema conceptual fluye a través de las representaciones léxicas de los dos idiomas, y, por tanto, evidencia una concepción no selectiva de activación de idiomas (Colomé, 2001; Costa, Miozzo, et al., 1999; Costa, 2005; Dijkstra et al., 1999; Dijkstra, 2005; Ju & Luce, 2004; Kroll, Bobb, & Wodniecka, 2006; Kroll & Stewart, 1994; Macizo, Bajo, & Martín, 2010; Marian, Spivey, & Hirsch, 2003; Spivey & Marian, 1999). Bajo esta perspectiva se asume que se produce la activación tanto de las entradas léxicas del idioma en uso como de las entradas léxicas del idioma alternativo. Más aún, esta activación simultánea de idiomas se ha observado incluso en combinaciones de idiomas con diferente sistema de escritura, como el inglés y el japonés (Hoshino & Kroll, 2008), así como en bilingües bimodales o hablantes de lengua de signos (Shook & Marian, 2012).

Las primeras aproximaciones hacia esta visión no selectiva parten de una adaptación de la tarea *Stroop* (MacLeod, 1991) al estudio del bilingüismo. En un experimento llevado a cabo por Preston y Lambert (1969) se demostró que los participantes bilingües inglés-francés eran más lentos al nombrar el color en el que estaba escrita una palabra si dicha palabra representaba un color diferente escrito en la lengua alternativa del hablante (p.ej. si se presentaba la palabra *blanc* en azul y lo que se tenía que responder era *blue*). Del resultado anterior se desprende que,

aunque el idioma relevante para la tarea era el inglés, los participantes activaban de manera paralela su idioma materno, lo cual llevaba a un proceso de competición e interferencia a la hora de seleccionar la entrada léxica apropiada para la tarea[2].

Entonces, ¿cómo está estructurado el sistema léxico y cómo están representadas las unidades léxicas en los hablantes de más de una lengua? Uno de los modelos más aceptados en producción lingüística bilingüe es el denominado Modelo Jerárquico Revisado (Kroll & Stewart, 1994; Kroll, van Hell, Tokowicz, & Green, 2010). Este modelo defiende la existencia de una única representación conceptual, la cual es compartida por ambas lenguas, y que está conectada con las representaciones léxicas del idioma nativo y del idioma alternativo (ver Figura 6). Aunque las unidades léxicas de cada idioma son independientes, ambas se muestran interrelacionadas entre sí. Por ejemplo, la representación conceptual de *mariposa* en un bilingüe español-inglés estaría vinculada a la entrada léxica correspondiente a su primer idioma (*mariposa*) así como a la de su segunda lengua (*butterfly*). No solo eso, sino que *mariposa* y *butterfly* estarían conectadas e interrelacionadas entre sí, lo que significa que las propiedades o características de los nodos de un idioma influyen sobre el idioma alternativo. Por tanto, este modelo defiende no solo la activación simultánea de idiomas, sino también la existencia de conexiones e interacciones entre las representaciones léxicas de cada idioma (volveremos sobre este tema en el último apartado de la introducción).

[2] Aunque el proceso de producción conlleva una última etapa consistente en seleccionar la entrada léxica más apropiada, trataremos este aspecto en una sección distinta de la introducción.

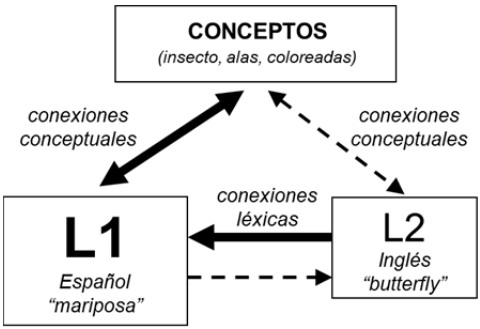

Figura 6 | *Modelo Jerárquico Revisado de las representaciones léxicas y conceptuales en bilingües (Kroll & Stewart, 1994). Las flechas indican la fuerza y dirección de las conexiones entre representaciones.*

Con el fin de estudiar en profundidad las interacciones que se producen entre los idiomas en personas bilingües, la mayoría de los estudios se basan en el uso de palabras que comparten propiedades léxicas, gramaticales, ortográficas o fonológicas entre ambas lenguas. En un estudio clásico de Hermans y colaboradores (Hermans, Bongaerts, de Bot, & Schreuder, 1998), bilingües holandés-inglés tenían que nombrar una serie de dibujos en su segundo idioma (p.ej. el dibujo de una montaña, "mountain" y "berg", en inglés y holandés, respectivamente) mientras ignoraban una palabra distractora sobreimpresa en ellos. Los autores manipularon la relación entre el nombre del dibujo y la palabra distractora, de manera que dicha palabra podía guardar relación fonológica con el nombre del dibujo en inglés-L2 ("mouth", boca), relación fonológica con la el nombre del dibujo en holandés-L1 ("berm", banco), o relación semántica ("valley", valle). Los resultados revelaron que los participantes fueron más lentos nombrando los dibujos en las dos últimas condiciones. Los autores explican este resultado argumentando que, al activarse de manera paralela los dos idiomas, la selección

léxica se vuelve más compleja cuando la palabra distractora recibe activación adicional (y, por tanto, genera más interferencia) cuando el nombre del dibujo comparte rasgos semánticos ("BERG", "valley") o rasgos fonológicos con la traducción del mismo ("BERG", "berm"). Sin embargo, los resultados demostraron que los participantes fueron más rápidos en la condición de relación fonológica ("MOUNTAIN", "mouth"). Al contrario que en el caso anterior, los autores explican este resultado argumentando que la selección léxica se ve facilitada al recibir la representación fonológica del nombre del dibujo activación adicional de la representación fonológica de la palabra distractora. Esta evidencia confirma la idea de que los bilingües no pueden evitar la influencia que su primer idioma ejerce sobre su lengua alternativa. Además, pone de manifiesto que existen interacciones entre cada una de las representaciones de los diferentes sistemas léxicos que posee una persona bilingüe.

En otro estudio de Costa y colaboradores (Costa, Caramazza, & Sebastián-Gallés, 2000), en el que participaron bilingües catalán-español, se observó que los hablantes eran más rápidos nombrando dibujos aislados cuando éstos hacían referencia a palabras que compartían rasgos fonológicos y ortográficos entre los dos idiomas (es decir, palabras cognadas; p.ej. *caja-caixa*, en español y catalán, respectivamente), en comparación a cuando las dos traducciones eran diferentes (p.ej. *manzana-poma*). Al igual que en el caso anterior, si la representación fonológica de ambos idiomas permanece activa, entonces la recuperación de la palabra objetivo debe ser más fácil y rápida en el caso de palabras cognadas. Esto es así porque, para este tipo de palabras, algunos segmentos fonológicos de la palabra en el idioma objetivo reciben activación adicional de la representación léxica del otro idioma,

cosa que no ocurre en el caso de no cognados (pero véase, de Groot & Nas, 1991[3]).

Bajo esta perspectiva, cabe esperar que la interacción entre idiomas no quede restringida únicamente a los niveles semántico y fonológico, sino que también se observe en otros niveles como pueda ser el género gramatical. De este modo, esperamos que este tipo de información léxica juegue también un papel determinante en el proceso de acceso y selección léxica en bilingües. El experimento presentado en el capítulo IV profundizará en este aspecto, y tratará de determinar cómo influye el género gramatical del idioma nativo en el acceso léxico de L2, lo que aportará nueva evidencia acerca de cómo está representada esta información en los diferentes sistemas léxicos que posee un bilingüe. Para ello registraremos los movimientos oculares de bilingües italiano-español en una tarea de búsqueda visual con instrucciones auditivas en L2 *(Visual World Paradigm)*. Esto nos permitirá observar con precisión cómo se produce la activación de las propiedades gramaticales de los nombres que sean congruentes o incongruentes en género entre los dos idiomas.

El registro de los movimientos oculares nos proporciona una herramienta muy valiosa para estudiar los procesos mentales que acompañan a la comprensión del lenguaje hablado (Allopenna, Magnuson, & Tanenhaus, 1998; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995). El paradigma de *Visual World*, que así es como se denomina en inglés, consiste en la presentación de

[3] De Groot y Nas (1991) proponen que las palabras cognadas comparten la representación conceptual entre los dos idiomas, mientras que las palabras no cognadas están almacenadas en nodos independientes y separados dentro de cada idioma. Esto explicaría por qué el acceso a las palabras cognadas ocurre más rápido en el caso de los bilingües.

una serie de dibujos junto a unas instrucciones verbales para seleccionar uno de ellos (p.ej. "encuentra la manzana"; véase, Huettig, Rommers, & Meyer, 2011, para una revisión de la metodología de este paradigma). Dado que los movimientos oculares proporcionan una medida finamente sincronizada con el procesamiento del discurso, podemos llegar a inferir los procesos de comprensión analizando el patrón de fijaciones de los participantes sobre la pantalla (Tanenhaus, Magnuson, Dahan, & Chambers, 2000). Por ejemplo, investigaciones previas han demostrado que, durante la interpretación del lenguaje hablado, las personas miran brevemente a los objetos cuyos nombres comparten rasgos fonológicos iniciales del nombre del objeto pronunciado (p.ej. en hablantes ingleses, fijaciones breves a una vela –*candle,* en inglés– cuando tienen que encontrar un caramelo –*candy*–; Spivey-Knowlton, Tanenhaus, Eberhard, & Sedivy, 1998).

En un estudio sobre acceso léxico en bilingües, Spivey y Marian (1999) emplearon esta tarea para examinar la co-activación de idiomas en bilingües inglés-ruso a nivel fonológico. En su estudio (ver Figura 7), presentaron a los participantes una serie de objetos en la pantalla (un sello, un rotulador, y dos objetos distractores adicionales), junto a una frase en L2 pidiendo que realizaran una acción determinada con uno de los dibujos presentados (p.ej. *"coloca el sello sobre la cruz"*). De manera crítica, la traducción rusa del dibujo crítico *sello* ("*marku*") comparte rasgos fonológicos con la traducción inglesa del dibujo distractor *rotulador* (*"marker"*), de manera que si ambos idiomas permanecen activos de manera simultánea, se podría observar la interferencia al seleccionar el dibujo correcto examinando el patrón de fijaciones sobre los dibujos. Los resultados

demostraron que los participantes miraban con más frecuencia al dibujo del *rotulador* cuando escuchaban la palabra rusa *marku,* en comparación con otros dibujos distractores que no compartían ninguna similitud fonológica entre los dos idiomas. Este patrón de resultados sugiere que los bilingües no pueden prevenir la activación e influencia de su primer idioma cuando están procesando el lenguaje hablado en L2 (Ju & Luce, 2004; Marian & Spivey, 2003a, 2003b), al igual que ocurre en tareas de producción.

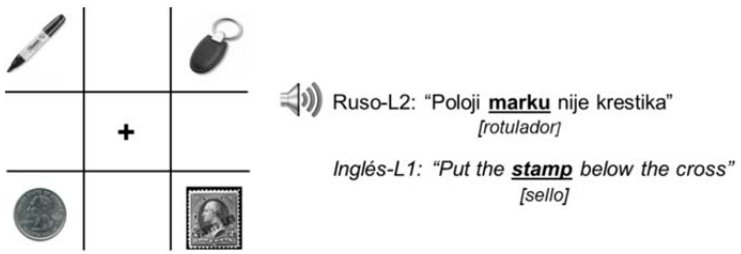

Figura 7 | *Ejemplo de los estímulos presentados en el experimento de Spivey y Marian (1999).*

Como hemos indicado anteriormente, los estudios presentados en este trabajo de investigación se dirigirán a estudiar los procesos de interacción entre idiomas atendiendo a la representación del género gramatical. Por ello, en el siguiente apartado revisaremos, de manera específica, la evidencia experimental en torno a cómo esta información interactúa entre los diferentes idiomas en bilingües.

El Género Gramatical en la Producción Lingüística Bilingüe

Tal y como acabamos de describir, los bilingües poseen un sistema conceptual compartido entre los dos idiomas, y, aunque

los sistemas léxicos correspondientes a cada uno de ellos son independientes entre sí, existen conexiones entre las representaciones léxicas de cada lengua (Costa, 2005; Dijkstra, 2005; La Heij, 2005). En este apartado de la introducción nos centraremos en describir las conexiones que se producen a nivel gramatical y profundizaremos en cómo la propiedad del género gramatical del idioma nativo influye en la recuperación y procesamiento de la información de género del idioma alternativo.

Como hemos visto, el género gramatical es una propiedad intrínseca de los nombres almacenada a nivel léxico (Cubelli et al., 2005; Gollan & Frost, 2001; Levelt et al., 1999). Respecto a la estructura del sistema de género en bilingües, existen dos posturas principales que explican cómo se accede a esta representación.

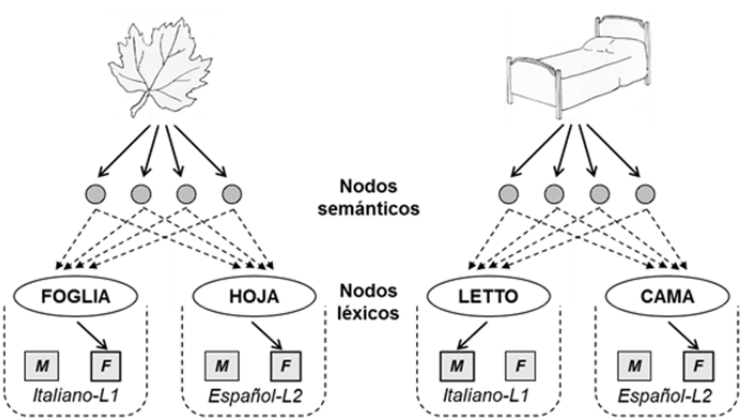

Figura 8 | *Representación esquemática del sistema de género independiente para palabras con mismo género (izquierda) o diferente género (derecha) entre idiomas. En ambos casos la información de género queda representada en cada idioma. Adaptado de Costa y colaboradores (2003).*

Una de ellas apoya la idea de que los sistemas de género en bilingües funcionan y están representados de manera autónoma (ver Figura 8), y defiende la existencia de un sistema de género diferente para cada idioma que, además, no interactúan entre sí (Costa, Kovacic, Franck, & Caramazza, 2003). Desde esta perspectiva, el sistema léxico de cada idioma tendría su propio sistema de representación de género y, por tanto, no se esperaría ninguna interacción del género entre idiomas en tareas de producción o reconocimiento de palabras. Por ejemplo, si un bilingüe italiano-español tuviera que nombrar el dibujo de una *cama*$_{FEM}$, el acceso a su representación léxica e información de género no se vería afectado por la incongruencia en género con respecto a su traducción al italiano (*letto*$_{MAS}$), ya que ambos sistemas de representación funcionarían de manera autónoma e independiente. En su primer experimento, Costa y colaboradores (2003) no encontraron ninguna influencia del género gramatical del idioma nativo en una tarea de denominación de dibujos en L2 con bilingües croata-italiano. No obstante, es importante señalar que ambas lenguas tienen sistemas de género diferentes. Mientras que el italiano cuenta con un sistema basado en dos categorías de género (masculino y femenino), el croata es una lengua con tres posibles valores de género para los nombres (masculino, femenino y neutro). Por tanto, esta asimetría en el sistema de género podría explicar la ausencia de efecto en sus resultados. Sin embargo, en sus siguientes experimentos, los autores encontraron una ventaja numérica (aunque sin diferencias estadísticamente significativas) a la hora de nombrar dibujos con nombres congruentes en género en bilingües español-catalán, catalán-español, e italiano-francés. No obstante, dado que la misma ventaja se observó en el grupo control de participantes monolingües, donde ninguna diferencia entre condiciones era de

esperar, podría estar indicando que el material no estuviera correctamente seleccionado y que, por tanto, fuera la causa de no encontrar efecto de género en la población bilingüe. Además, como indican los propios autores, es importante señalar que los participantes de sus experimentos eran bilingües muy fluidos en ambos idiomas, lo que pudo ser un factor determinante a la hora de encontrar una pobre influencia del idioma nativo sobre el procesamiento en L2 (Costa et al., 2003).

No obstante, la idea de tener un sistema de género autónomo entre idiomas dista mucho de ser el modelo más funcional a la hora de acceder a la información de género de cada idioma. Por un lado, la información semántica proporcionada por el género gramatical tiende a ser la misma entre idiomas diferentes (p.ej. *abuela*$_{FEM}$ y *nonna*$_{FEM}$, en español e italiano, respectivamente). Por otro, la desinencia de muchos nombres y adjetivos correlaciona con el valor del género gramatical en muchos idiomas (p.ej. en español e italiano la desinencia *–a* denota género femenino, mientras que la terminación *–o* indica género masculino). Por ello, una visión más acorde con estas observaciones pasa por apoyar la existencia de un sistema de género integrado y común para los diferentes sistemas léxicos de una persona bilingüe (Salamoura & Williams, 2007). Según esta postura (ver Figura 9), las palabras que comparten género gramatical entre diferentes idiomas activan la misma representación de género y, en consecuencia, la selección de estos nombres sería más rápida. En contrapartida, las palabras que difieren en género entre idiomas activan representaciones de género opuestas y, como resultado, la selección de las entradas léxicas correspondientes a este tipo de palabras sería más lenta.

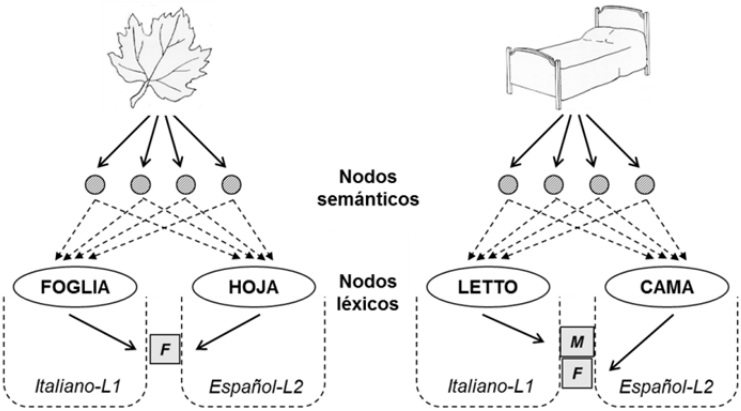

Figura 9 | *Representación esquemática del sistema de género compartido para palabras con mismo género (izquierda) o diferente género (derecha) entre idiomas. En ambos casos la información de género queda compartida entre cada idioma. Adaptado de Costa y colaboradores (2003).*

En este sentido, la evidencia experimental parece dar más apoyo a la idea de que los sistemas de género en bilingües están conectados e interrelacionados entre sí. En un estudio de Paolieri y colaboradores (Paolieri et al., 2010), bilingües italiano-español tenían que nombrar una serie de dibujos en L2, o traducir palabras de L1 a L2, usando el nombre aislado o el artículo de género correspondiente (el_{MAS} o la_{FEM}). La mitad de las palabras (o nombres de los dibujos) eran congruentes en género, mientras que la otra mitad eran incongruentes en género entre los dos idiomas (p.ej. $bufanda_{FEM}$-$sciarpa_{FEM}$, ambos de género congruente en español e italiano; o $seta_{FEM}$-$fungo_{MAS}$, de género incongruente). Los resultados pusieron de manifiesto que, en todos los casos, e independientemente de la tarea y el tipo de respuesta que los participantes debían emitir, éstos eran más lentos nombrando dibujos y traduciendo palabras en la condición de incongruencia de género. Este mismo efecto se ha

encontrado también en otro estudio de denominación de dibujos con bilingües alemán-holandés (Lemhöfer, Spalek, & Schriefers, 2008). Al igual que en el caso anterior, los hablantes fueron más lentos nombrando dibujos que hacían referencia a nombres incongruentes en género entre los dos idiomas (p.ej. *de fiets – das fahrrad*; bicicleta, en holandés y alemán, respectivamente) en comparación a nombres congruentes (p.ej. *de tuin - der garten*; jardín), tanto al producir los nombres aislados, como los nombres junto a su artículo de género correspondiente. Este efecto se ha observado también con bilingües checo-alemán, quienes fueron más lentos nombrando dibujos con nombres incongruentes en género entre los dos idiomas (p.ej. $burg_{FEM}$-$hrad_{MAS}$; castillo, en alemán y checo, respectivamente; en comparación a $hund_{MAS}$-pes_{MAS}; perro), tanto en la producción de nombres aislados como en la producción de nombres junto a un adjetivo marcado en género (Bordag & Pechmann, 2007). Por último, Salamoura y Williams (2007) también encontraron una ventaja en el procesamiento de nombres congruentes en género en bilingües griego-alemán. En este caso, la tarea consistía en traducir nombres del primer al segundo idioma, y, aunque los autores solo encontraron este efecto cuando los participantes tenían que usar un adjetivo que concordara en género (véase también, Bordag & Pechmann, 2008), interpretaron sus resultados como evidencia a favor de un sistema de género compartido entre los dos sistemas léxicos. Una posible explicación de que estos últimos autores no observaran la influencia del género en el procesamiento de nombres aislados pudo deberse a factores metodológicos. Así, el hecho de incluir en los análisis únicamente los estímulos presentados a partir de la segunda vez, así como emplear un procedimiento en el que los participantes debían decidir entre diferentes tipos de respuesta

según una serie de claves, pudo hacer que la influencia del género desapareciera en el momento de la respuesta de los participantes. En este sentido, el estudio de Paolieri y colaboradores (2010) solventó la influencia de factores relativos al uso de idiomas con diferentes sistemas de género, y controló los factores metodológicos en los experimentos anteriormente citados. Sus resultados mostraron un claro efecto de género con respuestas más rápidas en el caso de estímulos congruentes en género respecto a estímulos incongruentes, independientemente de la tarea (denominación de dibujos en L2 y traducción de palabras a L2) y del tipo de producción (nombre aislado o articulo + nombre), y empleando idiomas con sistemas de género similares (italiano y español).

Según estos resultados podemos concluir que existe un sistema de género conectado entre los dos idiomas de un bilingüe, bien porque existe un único sistema de género integrado (Salamoura & Williams, 2007), o porque las representaciones léxicas e información de género de las dos lenguas están relacionadas entre sí. Para explicar el efecto de congruencia de género en bilingües hay que considerar que, el hecho de que ambos idiomas permanezcan activos de manera simultánea, y que las palabras congruentes en género compartan más información entre ellas que las palabras incongruentes, hace que la activación de la palabra en L2 sea mayor y, por tanto, más fácil de seleccionar (ver Figura 10). Sin embargo, la interferencia generada cuando ambas traducciones difieren en género, hace que la selección léxica sea más lenta y, por tanto, demorada con respecto a las palabras congruentes. Por otro lado, el hecho de que la interferencia se observe en la producción de nombres aislados, y no solo cuando se requiere el acceso explícito a esta información, indica que la

selección de género ocurre a nivel léxico y de manera independiente a las demandas de la tarea (Paolieri et al., 2010). Esto explica por qué este efecto se encuentra también en tareas de traducción, donde el acceso a las entradas léxicas es obligatorio y, así, la activación de la información de género afecta al acceso de las entradas de L2.

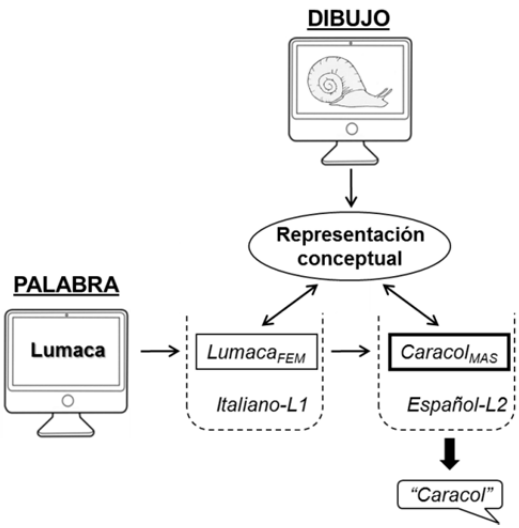

Figura 10 | *Representación del efecto de incongruencia de género en una tarea de denominación de dibujos en L2 y de traducción de L1 a L2, con bilingües italiano-español (adaptado de Paolieri et al., 2010).*

En resumen, la evidencia experimental parece indicar que, aunque los diferentes sistemas léxicos que posee una persona bilingüe sean independientes, el idioma nativo interacciona con las representaciones léxicas del segundo idioma también en el nivel de representación gramatical (Lemhöfer et al., 2008; Paolieri et al., 2010; Salamoura & Williams, 2007). Parte de los experimentos presentados en esta tesis irán destinados a investigar el efecto de congruencia de género en bilingües

italiano-español, tanto en una tarea de reconocimiento de palabras registrando los movimientos oculares (capítulo IV), como en una tarea de producción de denominación de dibujos (capítulo VI). Además, no solo nos centraremos en el estudio de estos procesos con idiomas basados en sistemas de género, sino que trataremos de determinar cómo el género gramatical del idioma nativo (esto es, español) puede ser transferido e influir la producción lingüística de un segundo idioma que carece de dicha propiedad, como es el caso del inglés (capítulo V). Hasta ahora, toda la evidencia que hemos presentado sugiere que el procesamiento del segundo idioma depende, parcialmente, de la estructura de L1, dado que algunas propiedades de la lengua nativa afectan al procesamiento de L2. Sin embargo, ¿qué ocurre cuando estas propiedades están ausentes en el segundo idioma? Este podría ser el caso del género gramatical, que, por ejemplo, para bilingües español-inglés es una propiedad presente en el idioma nativo, pero ausente en L2. En este caso, ¿podría el género gramatical ser transferido y afectar el procesamiento lingüístico de una segunda lengua que carezca de esta característica?

En el estudio de la transferencia de género entre distintos idiomas, la investigación se ha centrado únicamente en estudiar cómo las propiedades de género del idioma nativo pueden ser transferidas e influir el reconocimiento y la comprensión de palabras de un segundo idioma (Ganushchak, Verdonschot, & Schiller, 2011). Sin embargo, nadie hasta ahora ha tratado de investigar cómo estos factores afectan a la producción. En un estudio sobre comprensión en participantes bilingües, Midgley y colaboradores (Midgley, Wicha, Holcomb, & Grainger, 2007) pidieron a bilingües francés-inglés que leyeran una serie de frases escritas en L2 mientras registraban la actividad eléctrica cerebral.

Los nombres estaban precedidos por determinantes posesivos que concordaban en género con la traducción al L1 (p.ej. *his*$_{MAS}$ *shoe*$_{MAS}$ –su zapato–, siendo ambos elementos de género masculino en francés) o que no concordaban en género entre ellos (p.ej. *her*$_{FEM}$ *shoe*$_{MAS}$). Los resultados revelaron la existencia de picos positivos en la ventana temporal de 400-700 ms desde el comienzo del nombre en los ensayos incongruentes. Los autores interpretaron este resultado como evidencia de la influencia que el género del idioma nativo puede ejercer durante la comprensión de un segundo idioma que carece de esta propiedad gramatical.

La transferencia del género a otros idiomas, aunque parece mostrarse independiente de la existencia de esta propiedad en la segunda lengua, sí que parece depender de la similitud del sistema de género entre los idiomas (Franceschina, 2001, 2002; véase también, White, Valenzuela, Kozlowska–Macgregor, & Leung, 2004). En este sentido, Sabourin y colaboradores (2006) intentaron determinar cómo una serie de aprendices de holandés estaban influidos en su aprendizaje por su primer idioma dependiendo de la similitud en cuanto al género gramatical entre L1 y L2. De este modo, los aprendices podían ser nativos de alemán (una lengua con un sistema de género muy similar al holandés), nativos de inglés (un idioma que carece de género gramatical), o nativos de lenguas romances (idiomas con un sistema de género distinto, donde los morfemas de los nombres están marcados por género). Los participantes tenían que asignar el género correcto a una serie de nombres en L2, o bien juzgar gramaticalmente –atendiendo a la congruencia de género entre los elementos de la oración– una serie de frases presentadas también en L2. Los resultados demostraron que, aunque todos

los participantes fueron capaces de realizar bien la tarea de asignación de género, no ocurrió lo mismo con la tarea de juicio gramatical. Mientras que el grupo de nativos alemanes alcanzó el mejor nivel de ejecución, seguido por el grupo de nativos de idiomas romances, los ingleses ejecutaron la tarea sobre un nivel de azar. Por tanto, su estudio apoya la idea de que el género gramatical se puede transferir a otros idiomas que carezcan de dicha representación, y que esta transferencia va a depender en cierta medida del sistema de género existente en cada una de las lenguas.

Empleando el paradigma dibujo-palabra, los experimentos presentados en el capítulo V tratarán de determinar cómo el género gramatical de nativo hablantes de español influye en el procesamiento y afecta a los tiempos de respuesta en una tarea llevada a cabo en inglés-L2. Además, en estos experimentos controlaremos la variable de inmersión lingüística de los participantes, un factor que se ha mostrado determinante en cómo los bilingües ven favorecido su procesamiento en L2 gracias a la experiencia de inmersión lingüística (Linck, Kroll, & Sunderman, 2009). En este sentido, buena parte del trabajo de investigación realizado en el área ha intentado determinar la dinámica que permite, finalmente, seleccionar las entradas léxicas en el idioma apropiado y suprimir la lengua no relevante en un momento determinado. No obstante, los mecanismos que subyacen al proceso de selección de idiomas, mediante el cual las palabras que no son consistentes con la entrada léxica apropiada son eliminadas, están en la actualidad sujetos a discusión.

En el siguiente apartado de la introducción revisaremos las propuestas teóricas que tratan de dar respuesta a cómo se selecciona finalmente la lengua apropiada para cada ocasión, y

cómo se resuelve la interferencia generada por el acceso no selectivo y la activación paralela de idiomas.

SELECCIÓN DE IDIOMAS EN BILINGÜES

La evidencia experimental hasta el momento coincide en señalar que el flujo de activación que parte de la representación conceptual durante el acceso léxico en bilingües se dirige hacia las representaciones de los dos idiomas, y que esta activación no selectiva de idiomas deriva en una serie de procesos de competición a la hora de seleccionar las entradas léxicas acordes con la lengua en uso (Dijkstra, 2005; Hoshino & Thierry, 2011; Kroll & Stewart, 1994; Kroll, Sumutka, & Schwartz, 2005; Macizo, et al., 2010; Marian & Spivey, 2003a, 2003b). Por tanto, es importante averiguar cómo consiguen los bilingües controlar su producción lingüística de cara a solventar la interferencia producida por la co-activación de lenguas. Repasaremos a continuación qué modelos o propuestas existen para explicar cómo los bilingües finalmente seleccionan el idioma más apropiado a cada situación.

Una primera aproximación teórica al problema de la selección de idiomas asume que, aunque se produzca la activación simultánea de los dos idiomas, la mera intención de hablar en una lengua suprime la influencia de las representaciones léxicas del otro idioma, y que solo los ítems del idioma objetivo se tienen en cuenta para la selección y producción del habla (Costa & Caramazza, 1999; Costa, Miozzo, et al., 1999). En su experimento, Costa y colaboradores (Costa, Miozzo, et al., 1999) presentaron a bilingües catalán-español una serie de dibujos con palabras distractoras escritas en L1 o L2. Además, manipularon la

relación entre ambos estímulos, de manera que el dibujo y el distractor podían estar relacionados fonológicamente, semánticamente, o ser la traducción del nombre del dibujo al idioma alternativo. Los resultados demostraron el típico efecto de congruencia semántica, esto es, tiempos más lentos cuando dibujo y distractor están relacionados semánticamente entre sí. Además, este efecto fue independiente del idioma de presentación del distractor. Los autores interpretan este resultado aludiendo a que la representación conceptual del distractor activa las palabras correspondientes en cada idioma, pero que la competición ocurre únicamente entre el nombre del dibujo y el nombre del distractor dentro del idioma en uso. Los resultados también demostraron tiempos más rápidos en la condición de identidad, esto es, cuando presentaron como palabra distractora la traducción del nombre del dibujo en el segundo idioma (p.ej. el dibujo de una *mesa* junto a su traducción *taula* en catalán). Sin embargo, cabría esperar que los participantes mostrasen una peor ejecución en este tipo de ensayos, ya que el tiempo empleado para decir *mesa* sería mayor ya que el competidor *taula* recibiría activación tanto de la palabra escrita como del dibujo. Para explicar este resultado los autores sostienen que, aunque los dos idiomas se activen, la selección léxica toma en consideración únicamente los candidatos pertenecientes a la lengua objetivo (ver Figura 11). En este caso, el nodo *mesa* recibiría doble activación, por un lado la que procede del dibujo y por otro la que procede de la traducción escrita *taula.* Estos resultados apoyan la ausencia de competición entre las dos lenguas, aunque ambas se encuentren activas de manera paralela y, por tanto, los autores defienden que, aunque la activación de idiomas no sea selectiva en bilingües, sí lo sería la selección del idioma (Costa, Miozzo, et al., 1999). Sin embargo, si la selección léxica ocurre

dentro del idioma en uso, la activación del idioma alternativo sería un proceso irrelevante e innecesario. Visto así, la representación conceptual del distractor activaría conceptos relacionados que activarían las entradas léxicas correspondientes únicamente a dicho idioma.

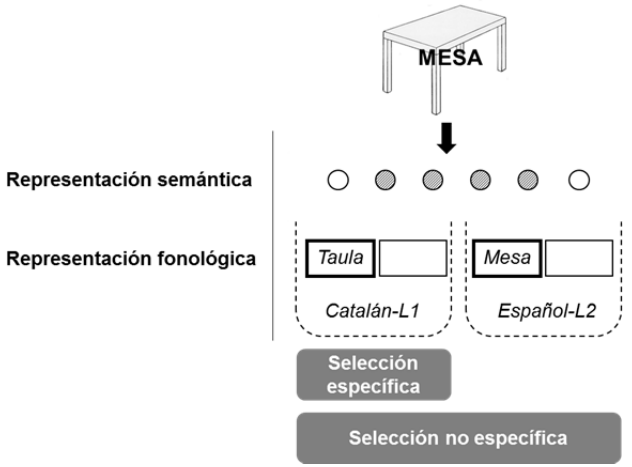

Figura 11 | *Representación de la hipótesis de selección específica y no-específica de idioma. Adaptado de Costa y colaboradores (Costa & Caramazza, 1999).*

Una segunda perspectiva al problema de la selección defiende que ambos procesos, activación y selección, no son selectivos, y que ambas lenguas son tenidas en consideración durante la selección léxica (Poulisse & Bongaerts, 1994). En esta propuesta, la selección del idioma apropiado se produce mediante el aumento de los niveles de activación de la lengua objetivo respecto al idioma irrelevante. Para ello, estos autores proponen la existencia de una serie de marcadores de idioma que modifican los niveles de activación de una de las lenguas. Así, el sistema léxico del idioma en uso recibe activación adicional de dichos

marcadores, proporcionándole mayor activación que al sistema léxico del idioma alternativo, y resolviéndose así la interferencia causada por la activación paralela de ambos idiomas. Por ejemplo, si le pedimos a un bilingüe español-holandés que nombre el dibujo de una *bicicleta* en L2, la representación semántica enviaría activación a las entradas léxicas de cada idioma (*bicicleta* y *fiets*). La activación de ambas entradas llevaría a un proceso de competición a la hora de seleccionar la entrada más apropiada. Sin embargo, la activación adicional recibida por el marcador de lengua *holandés* haría que la entrada *fiets* se viera potenciada y, así, finalmente seleccionada (ver Figura 12).

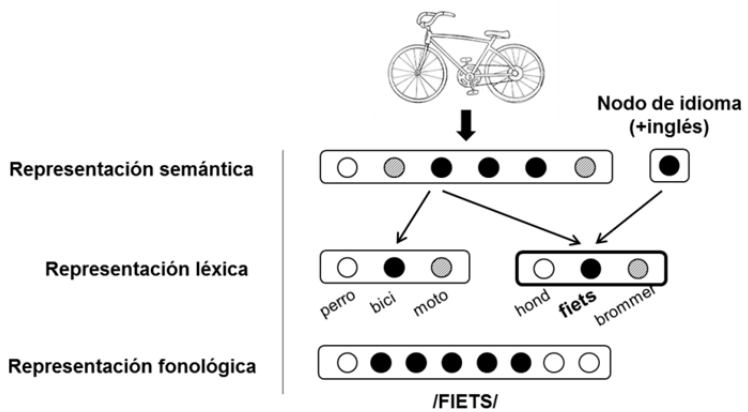

Figura 12 | *Modelo de producción lingüística bilingüe de Poulisse y Bongaerts (1994).*

Así pues, mientras Costa y colaboradores (Costa, Miozzo, et al., 1999) defienden que la competición léxica en bilingües queda restringida únicamente a los candidatos de la lengua en uso, Poulisse y Bongaerts (1994) mantienen que se produce una competición entre candidatos de las dos lenguas. Sin embargo, desde ambas posturas se defiende un mecanismo de selección

basado en la evaluación del grado de activación de los candidatos léxicos.

Finalmente, una de las perspectivas más influyentes que tratan de explicar cómo se lleva a cabo el control cognitivo en el procesamiento lingüístico en personas bilingües implica la puesta en marcha de mecanismos inhibitorios durante la selección de lenguas. En este sentido, la selección léxica de las entradas asociadas a la lengua objetivo tendría lugar gracias a la supresión de las entradas léxicas correspondientes a la lengua irrelevante (Abutalebi & Green, 2008; Green, 1998; Levy, McVeigh, Marful, & Anderson, 2007; Macizo et al., 2010; Meuter & Allport, 1999). Bajo esta perspectiva cabe destacar dos modelos basados en este tipo de procesos, los cuales intentan dar respuesta a la forma en la que se produce el control de idiomas en bilingües.

Uno de ellos es el modelo BIA (*Bilingual Interactive Activation model*, Dijkstra & van Heuven, 1998). Este modelo asume la existencia de un único sistema léxico que integra los dos idiomas, el cual estaría compuesto por cuatro niveles de representación: nivel de características de letras, nivel de letras, nivel de palabras, y nivel de nodos de idioma. Los dos primeros niveles serían los responsables de activar los candidatos léxicos en ambos idiomas, y activarían, a su vez, los nodos de idioma correspondientes a cada lengua dependiendo del contexto. La selección de idioma se llevaría a cabo mediante un proceso interactivo de activación e inhibición (ver Figura 13). Por un lado, las entradas léxicas más activas podrían inhibir las entradas léxicas del mismo idioma que más compitieran por la selección léxica mediante un sistema de inhibición lateral. Al mismo tiempo, la existencia de unos nodos de idioma, activados en distinto grado dependiendo del contexto,

se encargarían de inhibir las entradas léxicas del otro idioma. Por ejemplo, si pedimos a un bilingüe español-inglés traducir la palabra *advertencia* a L2, la similitud ortográfica y fonológica con la palabra inglesa *advertisement* (publicidad, en español) haría que ésta también se viera activada, no solo en inglés, sino también en español. Dado que las instrucciones proporcionadas a la persona son traducir a L2, el nodo de idioma proporcionaría una mayor activación a la entrada correcta *warning*, gracias a la inhibición lateral de los competidores léxicos.

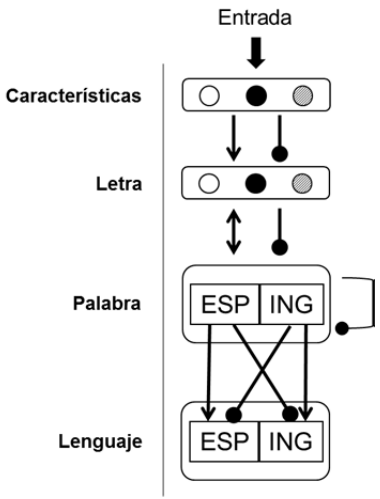

Figura 13 | *Representación esquemática del modelo BIA (Dijkstra & van Heuven, 1998). Se propone un sistema de activación (flechas) e inhibición (puntos) entre niveles.*

Pero dentro de esta visión inhibitoria, uno de los modelos más influyentes en la actualidad propone la existencia de mecanismos ejecutivos de control inhibitorio (*Inhibitory Control Model*, Green, 1998, ver Figura 14). Este autor considera que si la acción tiene que ser controlada por un mecanismo ejecutivo, y el lenguaje es una forma de acción que sirve para comunicarnos,

entonces el lenguaje tiene que estar regulado por el mismo sistema de control que el que se ocupa de regular nuestras acciones. El mecanismo de control de la acción propuesto por este autor está basado en el Sistema Atencional Superior de Norman y Shallice (SAS; 1986), que se encarga de aportar activación extra al esquema de tarea más relevante según los objetivos. Por ejemplo, el esquema de tarea para nombrar un dibujo en L1 debe ser diferente del esquema para nombrar un dibujo en L2 o traducir una palabra de L1 a L2, y si una tarea implica la traducción de una serie de palabras, el SAS aportaría más activación al esquema de tarea correspondiente a la tarea de traducción. Además, este modelo incluye un mecanismo de control interno al sistema léxico-semántico, con la función de regular la selección de la representación léxica correcta en el idioma apropiado sin que se produzcan errores. Cuando diferentes candidatos léxicos están activados y compitiendo entre sí por la selección, un segundo mecanismo de control dentro del sistema léxico-semántico entra en funcionamiento e inhibe aquellos candidatos irrelevantes. Debido a que el nivel de competición generado por este proceso precisa recursos atencionales, el grado de inhibición requerido dependerá del grado de activación de los competidores. Resumiendo, este modelo sitúa el control del lenguaje a dos niveles: (1) a nivel de esquema, llevándose a cabo por el SAS; y (2) a nivel léxico mediante la supresión de los candidatos del idioma irrelevante.

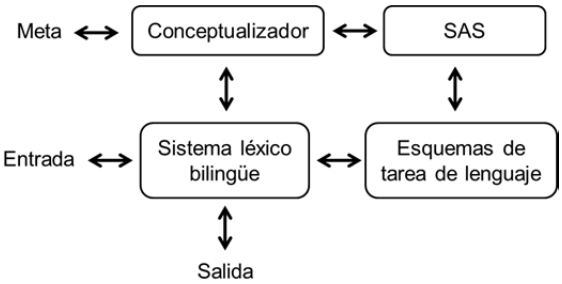

Figura 14 | *Representación esquemática del modelo de Control Inhibitorio (Green, 1998).*

Una fuente de evidencia experimental que da apoyo a esta propuesta proviene de estudios que requieren el cambio de idioma durante la realización de la tarea. Estos estudios han demostrado que el coste de cambio de idioma es mayor cuando los bilingües tienen que cambiar de L2 a L1, respecto a cuándo lo hacen de L1 a L2 (Costa & Santesteban, 2004; Kroll & Stewart, 1994; Meuter & Allport, 1999; Thomas & Allport, 2000). Por ejemplo, Meuter y Allport (1999) emplearon una tarea en la que pedían a los participantes nombrar una serie de números en L1 o L2 dependiendo del color en el que estuvieran escritos. Los resultados demostraron que cuando los participantes pasaban de nombrar en un ensayo de L2 a L1, los tiempos de respuesta eran más lentos que cuando nombraban en L2 y en el ensayo previo tenían que nombrar en L1. Según la explicación inhibitoria, cuando se realiza una tarea que implica el uso de L2 y, justo después se requiere reactivar L1, éste último está muy inhibido debido a su dominancia, y necesitaría tiempo adicional para reactivarse y ser usado nuevamente. Dado que la inhibición aplicada depende del grado de competición, en los ensayos de cambio de idioma L1 debe ser suprimido con más fuerza que L2,

debido a su dominancia, lo que explicaría este patrón de resultados en el coste de cambio de idioma.

Otra serie de investigaciones recientes han conseguido demostrar también cómo los mecanismos inhibitorios son los encargados de resolver la interferencia generada por la activación paralela de idiomas en bilingües (Macizo et al., 2010; Martín, Macizo, & Bajo, 2010). Bilingües español-inglés tenían que decidir si un par de palabras presentadas en L2 estaban relacionadas entre sí. Los resultados demostraron que los participantes eran más lentos respondiendo ante aquellos pares que incluían homógrafos y palabras relacionadas con la traducción de dichos homógrafos al español-L1 (p.ej. "*pie-toe*", –tarta y dedo, en español–), relativo a palabras que no tenían relación entre los dos idiomas. Este resultado indica que los participantes no fueron capaces de suprimir la influencia de su primer idioma, lo que se tradujo en competición y tiempos de respuesta mayores en los casos de pares relacionados. El resultado más importante, no obstante, fue que los participantes tardaron más en responder cuando, en el ensayo siguiente, aparecía la traducción al inglés del homógrafo que previamente había aparecido en español (es decir, *"foot"*, traducción de pie), lo que sugiere que dicho significado había sido inhibido durante el ensayo previo. Debido a esta inhibición, los participantes tenían que reactivar el significado de dicha palabra y, en consecuencia, los tiempos de respuesta fueron más largos.

Otra aproximación diferente para estudiar los procesos inhibitorios en la producción lingüística bilingüe ha sido propuesta por Levy y colaboradores (Levy et al., 2007). Estos autores apoyan la idea de que la inhibición juega un papel

funcional solucionando la interferencia durante la adquisición de una segunda lengua. Así, demuestran que el fenómeno de olvido de la lengua nativa durante el aprendizaje de un segundo idioma (Seliger & Vago, 1991) se produce, en parte, por la inhibición de la fonología de L1. En su estudio (para el cual adaptaron el paradigma de *Olvido Inducido por la Recuperación*; Anderson, Bjork, & Bjork, 1994) se basaron en el principio de inhibición propuesto por Green (1998), según el cual la inhibición aplicada es proporcional al nivel de activación de las palabras que han de ser inhibidas. Así, bilingües inglés-español tenían que nombrar una serie de dibujos en su segundo idioma una, cinco o diez veces. Debido a la interferencia generada por la activación del primer idioma, los participantes deberían inhibir los nombres de los dibujos en L1, y dicha inhibición sería mayor para aquellas palabras practicadas en L2 un mayor número de veces. Durante la segunda tarea, los participantes tenían que recordar en L1 los dibujos que habían sido presentados durante la tarea anterior, de acuerdo a una clave fonológica que rimaba con la palabra a recuperar (p.ej. *"shake-sn___"*, para recuperar la palabra *"snake"*). Según la hipótesis inhibitoria, si los bilingües deben suprimir las entradas correspondientes al idioma nativo para poder recuperar las entradas correspondientes al segundo idioma, se deberían observar tiempos de recuperación más lentos al preguntar por dichas palabras. Más aún, estos tiempos deberían ser incluso más lentos para aquellas palabras practicadas un mayor número de veces en L2, debido a la actuación repetida de los mecanismos inhibitorios sobre los nodos de L1. De hecho, los resultados confirmaron sus predicciones y mostraron que los participantes eran más lentos recordando las palabras que habían sido practicadas un mayor número de veces en L2 durante la primera tarea, demostrando claramente cómo el primer idioma tuvo que

ser inhibido durante dicha tarea para poder nombrar correctamente los dibujos en L2 (pero véase, Runnqvist & Costa, 2012).

Muy relacionado con la propuesta de que durante el aprendizaje de una nueva lengua se produce el olvido temporal del idioma nativo (Seliger & Vago, 1991), también se ha demostrado que la experiencia de inmersión en un contexto de L2 afecta al nivel de acceso de la lengua nativa (Linck et al., 2009). Un contexto de inmersión se caracteriza principalmente por el predominio de la exposición a la segunda lengua. Por tanto, la influencia del primer idioma podría verse reducida y, en paralelo, también el grado de competición entre los idiomas. En el estudio de Linck y colaboradores (2009), bilingües inglés-español inmersos en un contexto de L2 tenían que realizar una tarea de producción y comprensión en inglés, que incluía traducciones incorrectas (distractores) similares en significado o fonología respecto al español. Los resultados demostraron que, claramente, estos participantes eran mejores en comparación a un grupo de bilingües no inmersos en un contexto de L2. Pero, lo más importante, fue el resultado de que los bilingües inmersos producían menos ejemplares en L1 y más en L2, lo que sugiere que habían inhibido su primer idioma durante la experiencia de inmersión lingüística. Los autores interpretaron estos resultados como evidencia de que la inmersión lingüística supone una ventaja en el aprendizaje de L2 como resultado de la poca influencia que ejerce la lengua nativa al encontrarse inhibida.

Los últimos estudios de nuestra serie experimental se dirigirán a determinar la influencia que pueden ejercer estos mecanismos cognitivos en el procesamiento del género gramatical en bilingües. En los experimentos que presentamos en el capítulo V

estudiaremos no solo la transferencia del género gramatical a una segunda lengua como el inglés, sino que comprobaremos cómo estos efectos pueden ser modulados por la experiencia de inmersión lingüística en un contexto de L2. Por su parte, en el experimento presentado en el capítulo VI usaremos el paradigma de Levy y colaboradores (2007) para comprobar si la interferencia generada por la incongruencia de género en bilingües italiano-español es resuelta mediante la inhibición de la información de género gramatical del idioma nativo.

Organización y Objetivos de la Serie Experimental

La serie experimental incluida en el presente trabajo de investigación tiene como objetivo principal profundizar en el estudio del acceso léxico y la selección de la información de género gramatical tanto en monolingües como en bilingües. Esta serie queda estructurada de la siguiente forma.

Los experimentos incluidos en el Capítulo III se dirigen a examinar cómo se produce el acceso al género gramatical en dos idiomas romances como el español y el italiano. Siguiendo la propuesta de Cubelli y colaboradores (2005), acerca de que el acceso léxico implica la activación y selección de la información de género de las palabras, esperamos encontrar un efecto de congruencia de género en estos dos idiomas usando la tarea de interferencia dibujo-palabra en producción de nombres aislados. De ser así, podremos concluir que la selección de la característica de género gramatical de las palabras es un proceso automático y competitivo durante el proceso de acceso léxico en participantes monolingües.

Una vez comprobado cómo influye el género gramatical en el acceso léxico en estos dos idiomas por separado, tendremos la base para tratar de determinar cómo interacciona la información de género en bilingües italiano-español. Los experimentos incluidos en el Capítulo IV profundizarán en este aspecto mediante la técnica de registro de los movimientos oculares y el uso del paradigma *Visual World*. De este modo, manipulando la relación de género entre los dos dibujos en italiano, podremos determinar la influencia que ejerce esta información sobre el procesamiento lingüístico del español. De ser así, el hecho de que los dibujos presentados sean congruentes en género en español, pero incongruentes en italiano, hará que la selección y el patrón de fijaciones sobre el dibujo objetivo se vea enlentecido y demorado.

En el Capítulo V el énfasis recaerá en el estudio de la transferencia de la información de género a un idioma que carece de dicha representación, como el inglés. Si bien hay evidencia que demuestra que las propiedades gramaticales del idioma nativo se transfieren a otro idioma e influyen en el reconocimiento de palabras en una segunda lengua que no tenga esta información, hasta ahora no se ha estudiado cómo afecta esta transferencia durante la producción del habla en dichos idiomas. Para ello nos basaremos en población bilingüe español-inglés, y examinaremos de manera paralela el efecto que tiene la inmersión en un contexto de L2 –inglés–sobre la accesibilidad del idioma nativo. Si es así, deberemos encontrar que los bilingües no inmersos muestren una influencia clara del género en español sobre su segunda lengua, inglés. Sin embargo, esta influencia será menor o no existirá en aquellos bilingües inmersos en un país donde el inglés-L2 sea el idioma de uso principal.

Lo anterior nos dará una información muy valiosa acerca de cómo se produce la selección de idiomas en bilingües. No obstante, aunque la inmersión en L2 pueda provocar una posible inhibición de L1, en el Capítulo VI profundizaremos en el estudio de estos mecanismos inhibitorios de una manera más específica. Con este objetivo, trataremos de explorar los mecanismos cognitivos que se encargan de resolver la interferencia a nivel de género gramatical en bilingües italiano-español, siguiendo la propuesta del modelo de control inhibitorio (Green, 1998). De ser así, esperamos encontrar que el acceso a la información de género de L1 esté disminuido después de realizar una tarea que requiera el uso y acceso continuado al género de L2, y que este efecto sea mayor ante palabras incongruentes en género entre los dos idiomas debido a la interferencia adicional que produce esta competición entre representaciones.

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CHAPTER II

Introduction,

aims and structure of the thesis.

The capacity to process language by humans is an impressive cognitive skill given the complex mechanisms involved in comprehension and production. In a normal conversation, adult speakers produce between two and three words per second that need to be selected from a mental vocabulary composed of between 50,000 and 100,000 words (Miller, 1991). This capacity becomes even more difficult when people speak more than one language. In this respect, an important question in the field of Psycholinguistics is to understand how people are able to manage such a large word database and to select the correct lexical entries when needed during speech, comprehension and reading. Although the models that have tried to explain the mechanisms involved in lexical selection differ in several aspects, most of them agree about the main processes comprising lexical access.

In the first part of the Introduction we will describe the main models of language production that explain the lexicalization process (Caramazza, 1997; Dell, 1986; Levelt, Roelofs, & Meyer,

1999; Roelofs, 1992), going from the selection of the concepts to communicate, to the selection of the phonological and orthographic features that allow production of the intended words. Next, we will focus specifically on the processing of grammatical gender, i.e., a lexical property of nouns that classify them in different categories (e.g. masculine or feminine in the case of Spanish; or masculine, feminine and neuter in the case of Dutch) (Corbett, 1991). We will review how these models deal with the processing of grammatical gender, that is, how this property is represented and selected within the mental lexicon, and how grammatical gender can interfere with or facilitate the activation of upcoming words during the production of utterances or during the interpretation of speech.

Although lexicalization in bilinguals may proceed as in the case of monolingual speakers, the next section of the Introduction will describe in depth how the different languages are represented within the lexical system and how bilingual speakers access these representations. Current models of bilingual lexical access assume that the activation of languages occurs in parallel, and that the properties of the non-intended language affect the processing of the target language at several levels of representation (Dijkstra, 2005). In this way, not only co-activation, but also connections between the different languages of a bilingual speaker have been observed. Once we have introduced these models, we will discuss the specific role that grammatical gender plays during bilingual lexical access, and how parallel language co-activation influences grammatical gender processing in bilingual speakers.

In connection with the latter issue, the last section of the Introduction will describe the proposal explaining the

mechanisms involved in language selection in bilinguals. These models describe how bilingual speakers solve the interference caused by the parallel activation of languages and how they select the lexical entries that are more appropriate to the context (Costa & Caramazza, 1999; Dijkstra & van Heuven, 1998; Green, 1998; Meuter & Allport, 1999; Poulisse & Bongaerts, 1994). We will mainly emphasize the proposals that speak in favor of the existence of inhibitory mechanisms that suppress the non-intended language in order to facilitate the selection of the more appropriate target words (Green, 1998; Meuter & Allport, 1999). Once again, our discourse will focus on the processing of grammatical gender, trying to determine whether this property can be specifically inhibited when it is a source of between-language competition in bilinguals.

All of the studies reported in this thesis were conducted to answer the different research questions that will be presented throughout the different sections of the Introduction. Nevertheless, a final section of the Introduction will summarize the aims of each experimental series and the rationale and organization conducting the studies reported in this research work.

LEXICAL ACCESS IN MONOLINGUAL SPEAKERS

During language production speakers must retrieve from their mental lexicon the appropriate words for conveying the intended messages. In parallel, they have to select all these words according to the grammatical rules of the language being spoken. How do speakers appropriately manage to go through all these processes?

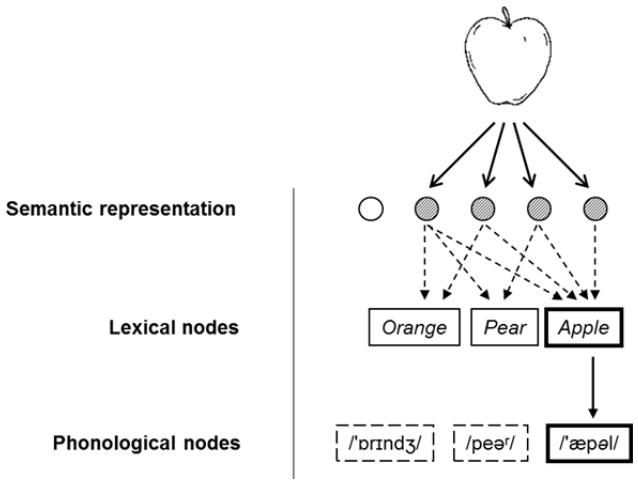

Figure 1 | *Schematic representation of the lexical system. The arrows represent the flow of activation and the thickness of the circles indicates the level of activation of the representations.*

The main models of language production agree that lexicalization involves the retrieval of three different levels of information (Caramazza, 1997; Dell, 1986; Levelt et al., 1999; Levelt, 1989): (i) a non-verbal conceptual representation which stores the meaning or semantic information of the words; (ii) a lexical representation in which both the syntactic and grammatical properties of the words are present; and (iii) the orthographic and phonological representations required for connecting the words to their sounds and final articulation (see Figure 1). Therefore, the activation flows through all these levels starting from the conceptual representation. But it is widely assumed that during the stage of conceptual preparation not only the intended concepts (e.g. *apple*), but also those semantically related (e.g. *orange* or *pear*) are activated to some degree. Then, the activation of the related concepts spreads to the corresponding lexical nodes

or words, forcing the lexical system to select the final intended word from among all the active candidates.

One way to investigate the process of lexical access is by examining the time that participants take in naming pictures. The picture-word naming interference task (Rosinski, Michnick-Golinkoff, & Kukish, 1975) consists of the presentation of a picture along with a superimposed distractor word. Participants are usually instructed to name the picture as quickly and accurately as possible while ignoring the distractor written word. Because naming latencies are affected by the relationship between the picture's name and the distractor word, this paradigm became a useful tool to study the processes involved during lexical access.

A series of seminal studies manipulating the semantic relationship between the two stimuli revealed that participants are slower naming the pictures when paired to semantically related distractor words (e.g. *LION-tiger*[4]) than when they are semantically unrelated (*LION-cloud*) (Lupker, 1979; Rosinski et al., 1975; Schriefers, Meyer, & Levelt, 1990). To explain this effect it is assumed that the activation of the lexical node corresponding to the target noun and distractor noun compete for its selection (Caramazza, 1997; Levelt et al., 1999; Roelofs, 1992; but see Mahon, Costa, Peterson, Vargas, & Caramazza, 2007). When target and distractor are semantically related, the noun of the picture spreads its activation to the name of the distractor word (among other conceptually related words), so that this word

[4] Henceforward, when talking about the picture-word interference paradigm, we will use uppercase letters to represent the noun of the pictures and lowercase letters to indicate the distractor words.

becomes more salient and interferes with the picture naming process. In contrast, when both items are semantically unrelated, the distractor word does not receive any additional activation from the picture noun, so that picture naming is easier relative to the related condition. The pattern of results is the opposite when target and distractor share phonological features (Lupker, 1982). In this case, the activation of the orthographic and phonological information of the distractor word facilitates the selection of the picture's noun and naming latencies are faster (e.g. LION-line), relative to conditions where both stimuli do not share phonology (e.g. LION-cloud) (Schriefers et al., 1990).

Grammatical gender is an inherent property of nouns that also plays an important role in the process of lexical access (Bates, Devescovi, Pizzamiglio, D'Amico, & Hernández, 1995; Bentrovato, Devescovi, D'Amico, & Bates, 1999; Grosjean, Dommergues, Cornu, Guillelmon, & Besson, 1994). Although most of the research on lexical access has focused on the retrieval of the phonological form of nouns, access to grammatical features or words, such as gender, is also needed. However, the way in which this feature is represented and stored within the lexical system is still controversial. The next section will specifically describe how grammatical gender is represented, stored and accessed during speech production according to the most prominent models of language production. Additionally, studies showing the influence of grammatical gender on language processing will be also discussed.

GRAMMATICAL GENDER AND LANGUAGE PRODUCTION IN MONOLINGUALS

Grammatical gender is an intrinsic and arbitrary property of nouns existing in many languages that allows them to be classified in different categories (Corbett, 1991). For instance, Romance languages like Spanish, Italian or French have a gendered system based on two classes, i.e. masculine and feminine. However, Germanic languages like German or Dutch have a tripartite gender system with a neuter gender value as an additional category. In the course of language production, speakers use gender information to achieve grammatical agreement between the different elements of the sentences (e.g. nouns and adjectives or pronouns). For instance, in the Spanish sentence *"la$_{FEM}$ casa$_{FEM}$ bonita$_{FEM}$"* (meaning *the pretty house*, in English) there should be gender agreement between the definite determiner and the adjective, given that they are syntactically dependent on the main noun phrase. This is expressed by the corresponding morphological form of the determiner or the inflection of the adjective.

According to the hierarchized structure of the lexical system, most prominent models of language production agree that grammatical gender is represented as a property of nouns stored at a different level from those specifying conceptual and phonological information (Caramazza & Miozzo, 1997; Caramazza, 1997; Levelt et al., 1999; Levelt, 1989; Roelofs, 1992). In this way, the model proposed by Levelt and colleagues (Levelt & Schriefers, 1987; Levelt, 1989) suggests that grammatical gender is represented as an intrinsic property of all nouns and that it is stored along with its corresponding syntactic properties and conceptual information at the so-called lemma level (see

Figure 2). Therefore, gender information is not represented as an independent node in this model, but it is represented as an intrinsic feature of nouns. In addition, the authors propose the existence of a second level of representation (i.e., lexeme level) in which both the morphological and phonological information of nouns are stored.

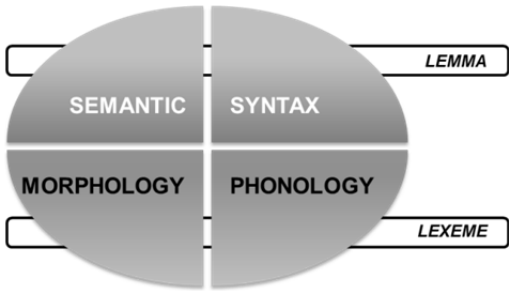

Figure 2 | *Original model by Levelt et al. representing the different levels of representation (Levelt & Schriefers, 1987; Levelt, 1989).*

This model was the seed of a more recent proposal by Levelt and colleagues, i.e. the WEAVER++ model (***W****ord-form* ***E****ncoding by* ***A****ctivation and* ***Ver****ification*) (Levelt et al., 1999; Roelofs, 1992), in which grammatical gender becomes an independent node stored at the lemma level and connected with the corresponding lexical representations (see Figure 3). An important issue of this model is that only the selected lexical entries (i.e., the lemmas) would spread its activation to the corresponding phonological information. But it also proposes that not all the syntactic properties connected to its lexical nodes are automatically selected (such as the information of grammatical gender). For that to occur, explicit access to this information is needed, i.e. when gender agreement between the different elements in the sentence is required. In contrast, when access to this information

is not needed, i.e. during the production of bare nouns, grammatical gender becomes an activated but not a selected lexical feature.

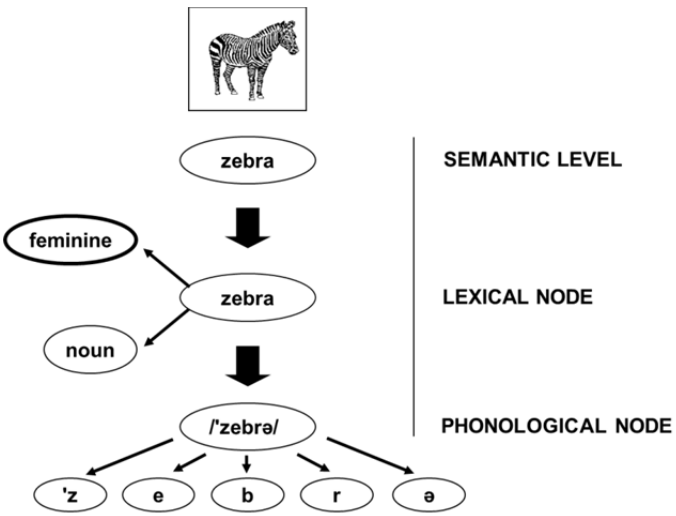

Figure 3 | *WEAVER++ model (adapted from Levelt et al., 1999; Roelofs, 1992).*

An alternative model has been proposed by Caramazza and colleagues (Caramazza & Miozzo, 1997; Caramazza, 1997). In their IN model (***I**ndependent **N**etwork*) the authors propose that both phonological and lexical information of nouns are automatically activated by its conceptual representation (see Figure 4). However, the mediation of the lexical level to activate the phonological representation of a noun is not needed, and the selection of grammatical gender becomes an automatic –but not competitive– process that follows the retrieval of phonological information of nouns.

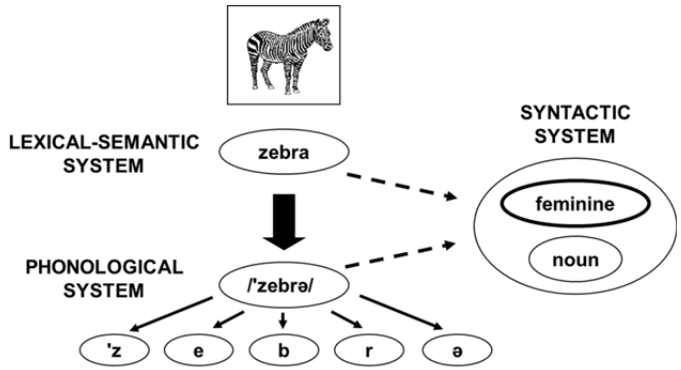

Figure 4 | *Independent Network Model (adapted from Caramazza, 1997).*

Both models also agree that the lexicalization process can occur without accessing grammatical gender information, given that gender selection only follows the production of gender marked utterances. Therefore, both models predict that in the picture-word task participants would access the gender information when they are asked to name pictures in the context of gender-marked definite determiners or adjectives, since determiners and adjectives are modifiers requiring grammatical agreement with the gender of the noun. In contrast, these models suggest that access to grammatical gender should not occur when participants are asked to name pictures in a bare noun context, since there will be no need to seek gender agreement with any other element. In fact, this prediction was investigated by using the picture-word interference paradigm in Dutch and German monolingual speakers (La Heij, Mak, Sander, & Willeboordse, 1998; Schriefers & Teruel, 2000; Schriefers, 1993). Specifically, these studies varied the gender congruency between the pictures' nouns and the distractor words, so that these stimuli were either gender congruent or gender incongruent. Importantly, participants were

asked to name the pictures with their corresponding definite determiner. In both languages definite determiners are marked for gender (in German: *der*, *die* and *das,* for feminine, masculine and neuter, respectively; in Dutch: *de* and *het* for common and neuter gender, respectively). By doing so, access to grammatical gender was required in order to select the appropriate gender-marked determiner. Indeed, results confirmed the hypothesis, and participants were slower naming the pictures when pictures' nouns and distractor words were incongruent in gender. In contrast, participants were faster naming the pictures when they were paired to gender congruent distractor words. Interestingly, nouns in Dutch and German are not overtly marked for gender, but this value is provided by the definite article or the adjective's suffix (e.g. *"de$_{MAS}$ groene$_{MAS}$ stoel"*, meaning *the green chair* in English). Consequently, grammatical gender effects should disappear when participants are asked to produce the bare nouns of the depicted pictures. Again, results from several studies confirmed this hypothesis, revealing that lexical access was not affected by the gender value of stimuli when access to grammatical gender was not explicitly required (La Heij et al., 1998; Schriefers, Jescheniak, & Hantsch, 2005; Starreveld & La Heij, 2004), supporting the notion that the selection of grammatical gender features is a competitive process that occurs only in the production of gender-marked utterances. According to Schriefers (1993), the activation of the gender feature of the distractor word interferes with the naming of the picture in the incongruent condition given that two different gender specifications compete for its selection.

Overall, this pattern of results seems to lead to the conclusion that grammatical gender access only occurs in the context of

gender-marked utterances, and that the lexicalization process can proceed without accessing grammatical gender information. However, there are several results that cast some doubts on this conclusion and that suggest that gender effects depend on the specific properties of the languages (Caramazza, Miozzo, Costa, Schiller, & Alario, 2001). First, Schiller and Caramazza (2002) found that gender effects in Germanic languages are not observed in the plural form (note that in Dutch and German there is only one determiner for plural, but they are different for singular, see below), suggesting that this effect originates at the selection of the singular gendered determiner and not at the selection of the feature grammatical gender. Second, several studies have not replicated gender-determiner congruency effects in Romance languages like Italian, French, Spanish or Catalan when participants were asked to produce the nouns of the pictures using either the definite determiners or adjectives (Alario & Caramazza, 2002; Costa, Sebastián-Gallés, Miozzo, & Caramazza, 1999; Miozzo & Caramazza, 1999). To explain this conflicting pattern, Miozzo and Caramazza (1999) proposed the distinction between early- and late-selection languages. In early-selection languages like German or Dutch, the selection of freestanding morphemes (e.g. determiners) can be initiated as soon as the gender of the noun is retrieved. However, in late-selection languages like Italian, the selection of the appropriate determiners has to wait until the phonological encoding of the noun. This happens because in Romance languages the selection of the determiners is constrained not only by syntactic information, but also by the phonological features of the languages. To illustrate, the masculine definite determiner in Italian is "*lo*" when the following word starts with a vowel, with the consonants *z, gn, ps,* or with an *s* followed by a consonant (in

all other cases, the masculine form is always "*il*"). It follows that in Romance languages the selection of the determiner occurs very late in the process of language production and there is enough time to solve the competition arising from the gender feature in the determiner selection. Therefore, when the determiner has to be selected it is possible that in Romance languages the influence of gender becomes "invisible" so that it is not observable during picture naming, at variance with Germanic languages, where the definite determiner is specified uniquely by the noun's gender.

Consistent with this proposal, recent studies in Italian have found this pattern of results (Cubelli, Lotto, Paolieri, Girelli, & Job, 2005; Paolieri, Lotto, Leoncini, Cubelli, & Job, 2011). Their findings showed consistent effects of grammatical gender in the production of bare nouns that disappeared when participants were required to produce the nouns of the pictures preceded by the definite gender-marked determiners, suggesting that gender effects depend on the specific properties of the languages. Note that this is opposite to the pattern of results observed in bare noun production in Germanic languages (La Heij et al., 1998; Schriefers et al., 2005; Starreveld & La Heij, 2004). In order to explain this inconsistency, Cubelli and colleagues propose that gender effects in bare noun production depend on the specific formal and morpho-syntactic properties of the languages (Cubelli et al., 2005). In Italian most feminine nouns are overtly marked for gender with the suffix –a, while masculine nouns are marked with the suffix –o (i.e. transparent nouns, like *finestra*$_{FEM}$ and *sedano*$_{MAS}$, meaning *window* and *celery*, respectively). However, other words end with the gender-opaque suffix –e (e.g. *pettine*$_{MAS}$ or *chiave*$_{FEM}$, meaning *comb* and *key*) and, therefore, this is a morphological mark that does not inform about the

gender value of nouns. This means that the retrieval of gender information occurs at a level of representation previous to the retrieval of phonological information (Cubelli et al., 2005). In contrast, nouns in Dutch and German are not morphologically marked for grammatical gender, which explains why the gender effect is not observed in these languages in bare noun production. Consequently, Cubelli and colleagues (Cubelli et al., 2005) agree that grammatical gender is stored at a lexical level and that its selection is a competitive process following the selection of the conceptual representation and preceding the selection of the phonological information of a word.

To explain the grammatical gender congruency effect it can be assumed that the active lexical representations of the picture's noun and distractor word compete for its selection. In a picture-word task, the orthographic representation enhances the level of activation of the distractor word, leading to slower naming latencies relative to when distractor words are composed, for instance, by a series of Xs characters (Cubelli & Paolieri, 2008). Furthermore, the fact that both nouns share grammatical gender adds additional interference during selection of the target noun, and naming latencies slow down relative to conditions where both nouns are mismatched in gender.

Spanish is a Romance language with a gender system similar to Italian. To illustrate, most nouns ending with the vowel *–o* denote masculine gender (e.g. *escritorio*$_{MAS}$, meaning *desk* in English) and those ending with the vowel *–a* indicate feminine gender (e.g. *casa*$_{FEM}$, *house*). Also, the opaque suffix *–e* gives no information about the gender of nouns (e.g. *llave*$_{FEM}$, *key*). Therefore, Spanish should behave as Italian with regard to gender

effects in bare noun production tasks. In Chapter III we report two studies testing this prediction with Italian and Spanish monolingual speakers. Thus, participants were asked to produce bare nouns for a series of pictures while ignoring distractor words that were either congruent or incongruent in gender with the name of the target. We expect to find slower naming latencies in the congruent condition for both groups of monolingual speakers (Spanish and Italian), indicating that grammatical gender is automatically selected in the process of lexical access even in conditions when there was no explicit requirement to access this information. These experiments provided important information for our next research question, which will deal with the process of grammatical gender access in Italian-Spanish bilinguals. In the next section, we will discuss the research regarding lexical access in bilingual speakers and, more specifically, how grammatical gender is represented and accessed within the bilingual lexical system.

GRAMMATICAL GENDER AND LANGUAGE PRODUCTION IN BILINGUALS

Most of the models regarding lexical access in bilinguals agree with the notion of a shared semantic system for the two languages of the bilingual (Costa, Miozzo, & Caramazza, 1999; de Bot, 1992; Kroll & Stewart, 1994; Poulisse & Bongaerts, 1994). As a consequence, lexical access in bilinguals is a difficult process since the selection of a given concept activates, at least, two different lexical entries. In this way, a large number of studies have tried to determine how lexical access occurs in bilinguals and how the specific properties of the native language influence and affect linguistic processing on the alternative language (Kroll

& de Groot, 2005). Several perspectives have been proposed to explain the organization of the lexical system in bilinguals.

Language-selective access models propose that the selection of a lexical entry uniquely affects the lexical entry corresponding to the intended language (Gerard & Scarborough, 1989; Scarborough, Gerard, & Cortese, 1984), and that lexical access in bilinguals should entail similar processes to those involved in monolingual speakers. In these studies bilingual speakers were asked to complete a lexical decision task in which the pseudowords varied in their similarity to words in the alternative language of the participants. Results revealed that the participants took the same time in responding to similar and dissimilar pseudowords, suggesting that the non-intended language did not influence the way in which bilinguals performed the task. However, later studies with similar procedures but including words that varied in phonological or orthographic similarity between the languages of the participants (Dijkstra, Grainger, & van Heuven, 1999; van Heuven, Schriefers, Dijkstra, & Hagoort, 2008) showed that participants were faster responding to words with a high orthographic similarity between languages, but they were slower responding to phonologically related words. Therefore, they concluded that the non-intended language was active and affected language processing in the alternative language (Dijkstra et al., 1999).

In fact, most of the evidence in this area provides support for models assuming non-selective language activation, so that activation spreads from the conceptual system to the two lexical systems of the bilinguals (Colomé, 2001; Costa, Caramazza, & Sebastián-Gallés, 2000; Costa, Miozzo, et al., 1999; Costa, 2005; Dijkstra et al., 1999; Dijkstra, 2005; Hoshino & Kroll, 2008; Ju &

Luce, 2004; Kroll, Bobb, & Wodniecka, 2006; Kroll, Dussias, Bogulski, & Valdés, 2012; Kroll & Stewart, 1994; Macizo, Bajo, & Martín, 2010; Marian, Spivey, & Hirsch, 2003; Shook & Marian, 2012; Spivey & Marian, 1999). The *Revised Hierarchical Model* (Kroll & Stewart, 1994; Kroll, van Hell, Tokowicz, & Green, 2010) proposes the existence of a shared conceptual system for the two languages, which is separately connected to the lexical representations of the native and alternative language (see Figure 5). In their model, however, lexical nodes of the languages are connected between them, which mean that the specific properties of one language influence and affect the access to the other language.

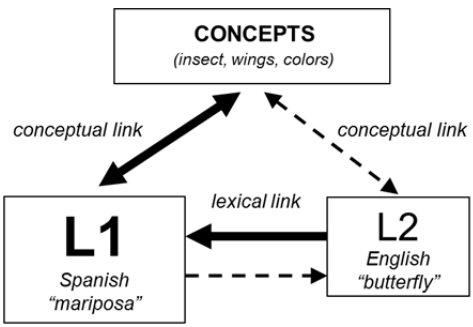

Figure 5 | *Revised hierarchical model of lexical and conceptual representation in bilinguals (Kroll & Stewart, 1994). The arrows indicate the strength and direction of the connections between representations.*

In a seminal study by Hermans and colleagues (Hermans, Bongaerts, de Bot, & Schreuder, 1998) Dutch-English speakers were asked to name a series of pictures in their L2 (e.g. the picture of a *mountain*, meaning *berg* in Dutch) while ignoring distractor words that could be phonologically related to the English name of the picture (e.g. *mouth*), phonologically related

to the translation of the picture noun (e.g. *berm,* meaning *bench* in English) or semantically related (e.g. *valley*). Results revealed slower naming latencies in the two latter conditions, suggesting that the two lexical systems of the bilinguals are simultaneously activated. The authors propose that lexical selection becomes more difficult when the more activated distractor word receives extra activation from either semantically related words or through translation words. In contrast, results revealed faster naming latencies when pictures' nouns and distractor words shared a phonological relationship. The authors argue that lexical selection is facilitated when the noun of the picture receives extra activation from phonological segments of the distractor word (but see de Groot & Nas, 1991).

Because evidence shows that both languages are active in parallel, we would expect between-language interaction to occur also at the level of grammatical gender, a linguistic property that could also play an important role in bilingual lexical access. The experiment included in Chapter IV deals with this topic and reports the results of a study carried out with eye-tracking methodology in Italian-Spanish speakers. Thus, using the Visual World paradigm (Huettig, Rommers, & Meyer, 2011) we explored whether the grammatical gender of the native language influences spoken language processing in L2. Because eye movements are finely synchronized to mental processing, this methodology provides us with an important tool for studying linguistic processing during the interpretation of spoken language (Allopenna, Magnuson, & Tanenhaus, 1998; Tanenhaus, Magnuson, Dahan, & Chambers, 2000; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995). To illustrate, Spivey and Marian (1999) have already used the Visual World

paradigm to provide evidence about cross-linguistic interaction effects at the phonological level in an experiment with English-Russian speakers. In their study the authors showed on a computer display several pictures, for instance, the picture of a stamp, a marker, and two additional distractors (see Figure 6) along with a spoken instruction in L2 (e.g. *put the stamp on the cross*). Crucially, the Russian translation of the picture's noun *stamp* (i.e. *marku*) shares a phonological relationship with the English noun of one of the distractor pictures (i.e. *marker*). Results showed that participants looked at the distractor picture *marker* more often than they did at the other distractor's pictures, suggesting that bilinguals cannot prevent the activation of the non-intended language and that both languages interact at the phonological level (Ju & Luce, 2004; Marian & Spivey, 2003a, 2003b). In the experiments that we describe in Chapter V we manipulated the grammatical gender of the depicted pictures and studied how this linguistic property interacts between languages in Italian-Spanish speakers.

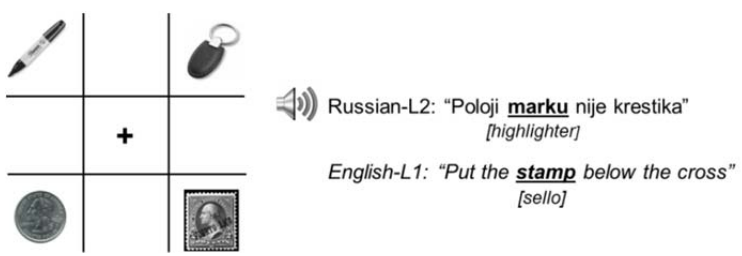

Figure 6 | *Illustration of a trial in the experiment by Spivey and Marian (1999).*

Regarding the organization of the grammatical gender system in bilinguals, several alternatives have been proposed. Costa and colleagues (Costa, Kovacic, Franck, & Caramazza, 2003) defend the existence of separated gender systems that do not interact

with each other (see Figure 7). In consequence, no cross-language gender effects are expected to occur in bilinguals. In their first experiment results showed that Croatian speakers were not influenced by the gender of their native language when naming a series of pictures in their L2 Italian. However, the asymmetry between the gender systems of the two languages (i.e. a two gender system value in Italian vs. a tripartite gender system in Croatian) could have explained the absence of any gender effect. In their following experiments the authors found a numerical – but not significant– advantage in processing gender congruent words in Spanish-Catalan, Catalan-Spanish and Italian-French highly proficient speakers. However, although the high proficiency of the bilinguals could have limited the influence of their native language on L2 processing, the finding of gender congruency effects in the monolingual control group seems to indicate that other factors apart from grammatical gender influenced the results.

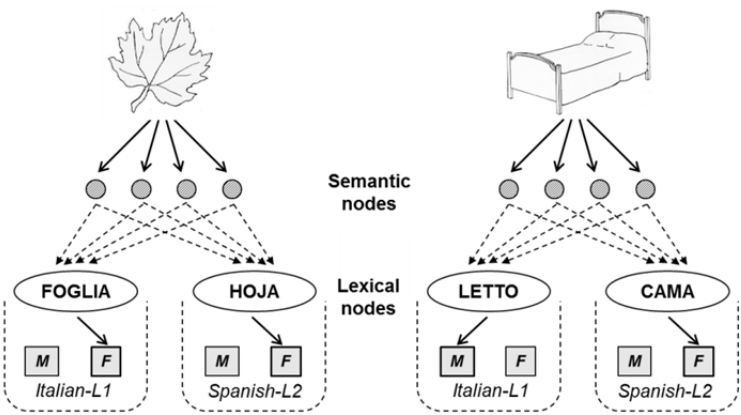

Figure 7 | *Schematic representation of the gender autonomous representation hypothesis with words of the same gender (left) or different gender (right) across languages (adapted from Costa et al., 2003). In both cases there are two gender features for each language.*

In contrast to this perspective, the notion of a common shared L1-L2 gender system has also been proposed (see Figure 8). In this way, the gender value of the words in the non-response language affect processing in the response language (Salamoura & Williams, 2007). Hence, nouns sharing similar gender across languages would activate the same gender representation, so that the process of lexical access becomes faster in comparison to incongruent gender nouns.

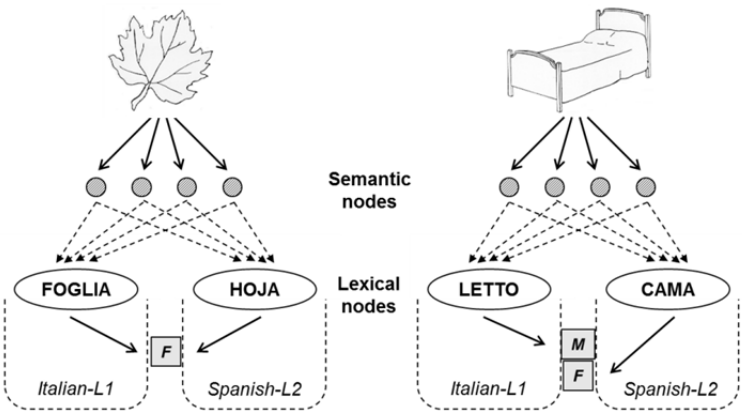

Figure 8 | *Schematic representation of the gender integrated representation hypothesis with words of the same gender (left) or different gender (right) across languages (adapted from Costa et al., 2003). In both cases there are two gender features shared by the two languages.*

For example, Paolieri and colleagues (Paolieri et al., 2010) had Italian-Spanish speakers translate words or name a series of pictures in L2 by producing either the bare noun or using the gender marked definite article (el_{MAS} or la_{FEM}). Regardless of the task and the type of response, results revealed slower naming latencies with incongruent gender words between languages (e.g. $seta_{FEM}$ – $fungo_{MAS}$, mushroom in Spanish and Italian,

respectively) relative to congruent gender words (e.g. *bufanda*$_{FEM}$ – *sciarpa*$_{FEM}$, scarf). Moreover, the advantage in processing words with similar gender across languages has also been found in German-Dutch (Lemhöfer, Spalek, & Schriefers, 2008), Czech-German (Bordag & Pechmann, 2007) and Greek-German (Salamoura & Williams, 2007) bilinguals, supporting the existence of a shared gender system between languages. Although Salamoura and Williams (2007) failed to find gender effects in bare noun processing (see also Bordag & Pechmann, 2008), they agree about the existence of a shared L1-L2 gender system. The absence of gender effects in bare noun processing in the last study may have been due to methodological factors (e.g. to exclude from the analysis the items appearing in the first presentation, or to provide complex instructions to the participants) that could prompt a delay in response latencies, possibly masking gender effects. The fact that Paolieri's study (Paolieri et al., 2010) found gender effects during a forward translation task when controlling these methodological aspects, also speak in favor of a shared grammatical gender system in bilinguals.

To explain the grammatical gender effect it is important to note that both languages are assumed to be simultaneously active in the bilingual mind and that congruent gender nouns share more between-language information than incongruent gender nouns (see Figure 9). Because of this, words with a similar gender value across languages are rapidly accessed with regard to words that do not match in gender, and faster response latencies are observed. In addition, the fact that gender effects are also observed in bare noun processing, where explicit access to gender information of nouns is not required, seems to indicate that

gender is represented at a lexical level and as an abstract property existing in all nouns (Paolieri et al., 2010).

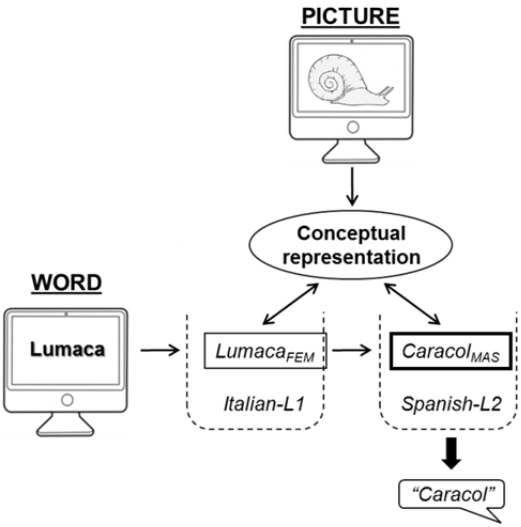

Figure 9 | *Schematic representation of the gender incongruency effect in a picture naming task in L2 and in a translation task to L2 with Italian-Spanish bilinguals (target word Snail, in English, adapted from Paolieri et al., 2010).*

The experiment reported in Chapter IV explores how grammatical gender of a native Italian speaker affects spoken word recognition in their second language Spanish. Additionally, the experiment reported in Chapter VI presents evidence suggesting that grammatical gender interacts between these two languages during a production task in L2. Moreover, the experiments covered in Chapter V tried to determine whether grammatical gender of the native language can be transferred and influences language production in a second language lacking this information (i.e. English). Although several studies have investigated how native gender affects word recognition and comprehension processes in L2 English (Franceschina, 2001,

2002; Ganushchak, Verdonschot, & Schiller, 2011; Midgley, Wicha, Holcomb, & Grainger, 2007; Sabourin, Stowe, & de Haan, 2006), there is no evidence on gender transfer effects to L2 production. To illustrate this, in the ERP study by Midgley and collaborators (2007) the authors asked French-English speakers to read a series of sentences in L2. Critically, nouns in sentences were preceded by possessive determiners that either matched in gender (e.g. *his*$_{MAS}$ *shoe*$_{MAS}$ –his shoe–, with both elements being congruent in gender in French) or mismatched in gender according to the L1 translation (e.g. *her*$_{FEM}$ *shoe*$_{MAS}$). ERP data revealed a positivity in the temporal window of 400-700ms from noun onset in the incongruent condition, evidencing that native gender information influenced sentence comprehension in a language where this property is not present.

Using the picture-word interference task, the experiments reported in Chapter V provide evidence of how grammatical gender of native Spanish speakers influences language production in English. In addition, we explored whether language immersion constrained access to the native language (Linck, Kroll, & Sunderman, 2009) and modulated gender transfer effects. Numerous studies have tried to determine the way in which bilinguals manage to control language production due to the parallel activation of languages. Although language immersion context is a factor that can cause a loss of access to the native language (Linck et al., 2009), many other mechanisms have been proposed to explain how bilinguals are able to control their linguistic production, resolve the competition arising from the non-selective language activation, and finally select the intended language at the most appropriate and right moment.

LANGUAGE SELECTION MECHANISMS IN BILINGUALS

Experimental evidence has shown that conceptual activation in bilinguals spreads not only to the lexical entries corresponding to the language in use, but also to the lexical system of the alternative language, thus causing interference during selection of the intended lexical entries (Dijkstra, 2005; Hoshino & Thierry, 2011; Kroll & Stewart, 1994; Kroll, Sumutka, & Schwartz, 2005; Macizo et al., 2010; Marian & Spivey, 2003a, 2003b). Hence, it is important to identify which cognitive processes are involved in the control of languages in bilinguals and how people speaking several languages select the appropriate lexical entries given the interference caused by the simultaneous activation of the two languages.

One of the proposals is the *Bilingual Interactive Activation* model (Dijkstra & van Heuven, 1998) which assumes that the lexicon is integrated across languages, and that lexical access is parallel and nonselective. They also propose the existence of four different representational levels: features (graphical), letters, words, and language nodes (see Figure 10). Graphical features and letters would be responsible for activating the corresponding lexical entries in both languages, which in turn would activate the corresponding language nodes. Then, an interactive mechanism of activation and inhibition between and within levels would act to select the more appropriate lexical items: (i) The more activated lexical entries could suppress the lexical entries competing for selection through a lateral inhibitory system; and (ii) the more activated language nodes could also inhibit the interfering lexical entries in the alternative language.

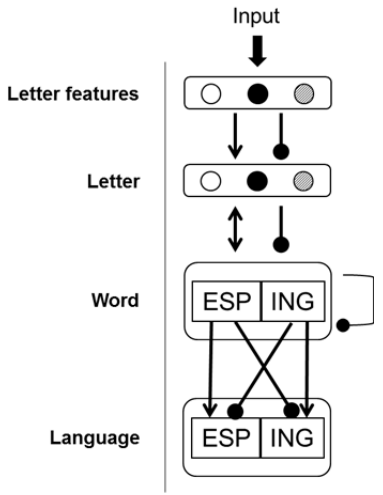

Figure 10 | *Schematic representation of BIA model (Dijkstra & van Heuven, 1998) with an interactive mechanism of activation (arrows) and inhibition (dots) between and within levels.*

However, one of the most important models within the inhibitory perspective is the *Inhibitory Control* model proposed by Green (1998). According to the IC model, language processing involves different levels of control (see Figure 11). First, task schemas allow bilinguals to select the appropriate task by suppressing the non-intended task (e.g. reading or translating words). Second, an internal lexical-semantic mechanism exerts control by inhibiting the competing lexical representations from the non-intended language. Resolution of the competition from the non-intended language requires attentional resources. An assumption of the IC model is that inhibition is proportional to the activation level of the words to be inhibited, so that the higher the activation of competing entries, the higher the inhibition needed to solve it.

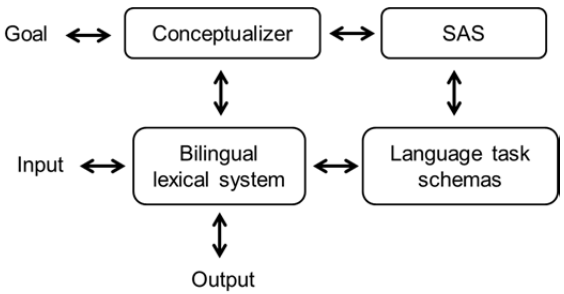

Figure 11 | *Schematic representation of the Inhibitory Control Model proposed by Green (1998).*

Experimental evidence supporting this assumption comes from studies using the language switching paradigm, where the response language varies in an unpredictable manner during the task (Meuter & Allport, 1999). These studies usually reveal asymmetric language switching costs, since bilinguals take longer to switch into L1 –the dominant language– than to L2 –their less dominant language– (Costa & Santesteban, 2004; Kroll & Stewart, 1994; Meuter & Allport, 1999; Thomas & Allport, 2000). According to the IC model (Green, 1998), the use of L2 leads to stronger inhibition of L1, so that later switching to L1 (the participants' native language) is most costly because of the need to overcome stronger inhibition.

The inhibitory mechanism seems to act at specific levels of representation within the lexical system, as has been demonstrated by a series of recent studies (Macizo et al., 2010; Martín, Macizo, & Bajo, 2010). In their studies, Spanish-English bilinguals had to judge the relationship between a pair of words presented in L2. Results revealed that participants were slower in responding to the pairs when they included an homograph along with a word related with the L1 translation to the homograph

(e.g. *pie-toe*, with *foot* being the Spanish translation of *pie*), suggesting that bilinguals could not avoid the influence of their native language while performing the task. More importantly, however, response times were even slower when subsequent trials included the English translation of the Spanish meaning of the homograph presented in the previous trial (i.e. *foot-toe*), indicating that lexical entries were specifically inhibited. Because of this inhibition, participants took longer to reactivate these words and responses times increased. Similarly, Levy and colleagues (Levy, McVeigh, Marful, & Anderson, 2007; but see Runnqvist & Costa, 2012) have adapted the so-called Retrieval-Induced Forgetting paradigm (Anderson, Bjork, & Bjork, 1994) to study how inhibitory control can act at specific levels within the lexical system to solve between-language competition in bilinguals. In their study, English-Spanish bilinguals were asked to name a series of pictures in L2 once, five or ten times with the assumption that the greater the repetition of trials in L2, the higher the inhibition of L1. Afterward, the accessibility to the corresponding words in the native language was measured using a rhyme test (e.g. *shake-sn___*, to recall the word *snake*), showing that naming pictures in Spanish 5 or 10 times led to decreased recall of the corresponding English names relative to those that were named only once. Moreover, presenting semantic cues (e.g. *venom-sn___*) did not produce the forgetting effect of repeteadly naming pictures in L2, concluding that phonological first-language attrition arises from specific inhibition of the phonological native language representations during second language use.

The notion that learning a second language can lead to a loss of access of the native language (Seliger & Vago, 1991) has also been

explored in the context of immersion. Linck and collaborators (2009) showed that L2 language immersion produced temporal inhibition of L1, improving L2 learning by attenuating the negative influence of L1. In their experiment, English-Spanish speakers immersed in an L2 context were exposed to a production and comprehension task. The results revealed that this immersed group outperformed classroom learners of Spanish non-immersed in a Spanish context. But, more importantly, their results also showed that immersed learners inhibited their L1 while living in the L2 context, supporting the notion that bilinguals must launch inhibitory processes to suppress one of the languages when using the other (Abutalebi & Green, 2008; Green, 1998). The last studies presented in this thesis address this topic, and explore how inhibitory processes are in charge of managing language control in bilinguals at the specific level of grammatical gender and how the language immersion context can modulate bilingual lexical access. Specifically, the experiment reported in Chapter V will show that grammatical gender of the native language can be transferred and affect language processing in a second language lacking this feature (i.e. English), and that L2 immersion can prevent its influence. Additionally, in Chapter VI we report a study showing that grammatical gender knowledge of Italian-L1 can be inhibited while performing a task in Spanish-L2 where this representation produced interference and competition between languages.

AIMS AND ORGANIZATION OF THE EXPERIMENTAL SECTION

The complete experimental series that we present in this thesis addresses different aspects of lexical access at the level of grammatical gender in monolingual and bilingual speakers as well as language control mechanisms in bilinguals. The experimental section is organized as follows.

The studies included in Chapter III examine how grammatical gender access occurs in Spanish and Italian languages. According to Cubelli's proposal (Cubelli et al., 2005), the gender congruency effect seems to depend on the specific properties of the language involved, as it has been found in bare noun production tasks in Romance languages like Italian (Paolieri et al., 2011), but only in noun phrase production in Germanic languages like German or Dutch (La Heij et al., 1998). Because Spanish is a language with a similar gender system to Italian, we expected to find an influence of the grammatical gender on bare noun production in these two languages. That being the case, we can conclude that access to grammatical gender is an automatic and competitive process whenever lexical access occurs, at least in morphologically complex languages.

Having established the evidence for the last assumption, the experiments in Chapter IV examined the way in which grammatical gender is represented within the lexical system and how this property interacts between languages in Italian-Spanish bilinguals. Using the Visual World paradigm we varied the L1 gender relationship between the depicted pictures to determine how this information affects spoken word recognition in L2. Therefore, we expected to find delayed fixations to the target

pictures when pictures' nouns are congruent in gender in Spanish but incongruent in gender in Italian, showing that bilinguals cannot prevent the influence of the native information of this property during spoken processing.

In the experiment reported in Chapter V, we studied the transfer of grammatical gender knowledge from a native gendered language (Spanish) to a language lacking this information (English). Using the picture-word paradigm we expected to find slower picture naming latencies in English when they appeared along with a distractor word of the same gender value according to the Spanish translation. Additionally, by varying the language immersion context of our participants, we could determine how this experience diminished the influence of the native language on second language processing. Thus, while non-immersed bilinguals should show a clear influence of their native grammatical gender even when performing the task in English, no effects should be found when bilingual speakers are immersed in the L2 country. These findings would speak in favor of the role of language immersion in modulating lexical access in L2, partly supporting the notion of inhibitory processes of the native language.

Nevertheless, direct evidence for the existence of language inhibition in bilinguals is provided in the study presented in Chapter VI. Because grammatical gender is a lexical property that can cause interference in bilinguals, we suggest that this information should be inhibited in order to solve between-language competition at this level in Italian-Spanish bilinguals. Using a similar procedure to that used by Levy and colleagues (Levy et al., 2007), we expected bilingual speakers to be slower naming a series of pictures in L1 when they were previously

asked to name them in L2, and this effect is stronger for those nouns incongruent in gender between the two languages.

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Chapter III

Experiments 1 and 2

Grammatical gender processing in romance languages: Evidence from bare noun production in Italian and Spanish*

The selection of grammatical gender in bare noun production is a controversial topic. In two experiments with the picture–word interference paradigm we confirmed a reliable effect of grammatical gender congruency in bare noun production in Italian and we replicated this effect in Spanish, another Romance language with a gender system analogous to the Italian one. In both Experiments, naming times were slower for picture–word pairs sharing grammatical gender. The results of the present study support the notion that grammatical gender is an intrinsic lexical property and not a pure syntactic feature selected only in noun phrase production. We assume that grammatical gender selection is crucial in languages with a complex morphological structure, like Italian and Spanish, in which the ending vowel is itself marked for grammatical gender.

* The studies included in this chapter correspond to the content of the paper published as Paolieri, D., Lotto, L., Morales, L., Bajo, M. T., Cubelli, R., & Job, R. (2010). Grammatical gender processing in romance languages: Evidence from bare noun production in Italian and Spanish. *European Journal of Cognitive Psychology*, *22*, 335–347.

In producing an utterance we need to retrieve concepts and words from the mental lexicon. The process that makes possible to connect the concept *dog* with the proper word "dog" is referred to as lexical access. This step is a small part of the whole process of language production, since access to specific words involves the retrieval of additional lexical properties associated to such words, (e.g. syntactic properties and orthographic and phonological specifications). Numerous researchers have focused their efforts on exploring how words and specific properties are represented within the lexical system. Specifically, in this study we investigate the selection of grammatical gender features in two Romance languages (Italian and Spanish) and the role that this representation plays in lexical access and production.

To investigate the processes involved in lexical access, one of the most employed experimental procedures is the picture-word paradigm introduced by Rosinski, Golinkoff, and Kukish (1975). In this task, participants are required to name a picture depicting an object as fast as possible and to ignore a superimposed written word. Naming latencies are affected by the relationship between the picture's name and the distractor word, allowing inferences to be made about the mechanisms underlying lexical access and verbal production (see, for instance, Mahon, Costa, Peterson, Vargas, & Caramazza, 2007).

Differential effects have been observed when the two stimuli share semantic, grammatical, or phonological features, thus supporting the notion that lexical representation comprises information that are specified at different processing levels (Caramazza, 1997; Levelt, Roelofs, & Meyer, 1999). For grammatical gender, when bare noun production is required, an interference effect of gender has been found in Italian (Cubelli,

Lotto, Paolieri, Girelli, & Job, 2005; Paolieri, Lotto, Leoncini, Cubelli, & Job, 2009), but not in Dutch (La Heij, Mark, Sander, & Willeboorsde, 1998; Starreveld & La Heij, 2004).

In Italian, the effect of grammatical gender has been observed in a large series of experiments where we manipulated orthogonally the gender congruency of target and distractor pairs and either the semantic relatedness (Cubelli et al., 2005) or the identity of the final vowel (Paolieri et al., 2009). In both studies a main interference effect of grammatical gender congruency was found, with slower response times to stimulus pairs sharing the same gender. The effect is independent from the semantic relatedness of the stimuli and the morphological transparency of the target and distractor nouns. It is present both when the noun pairs are semantically related and when they belong to different semantic categories; further, it appears both when the target name and the distractor noun share the same ending vowel and when they have different suffixes for gender.

The interference effect of grammatical gender congruency is not consistent with the assumption of the most prominent models of language production (Caramazza, 1997; Levelt et al., 1999), which differ in their functional architecture in several details, but share the notion that gender is selected only in producing gender-marked utterances: When no syntactic agreement is required, speakers access the phonological form of a noun without selecting its grammatical gender.

To explain the different pattern of results in Italian, and Dutch, Cubelli et al. (2005; see also Cubelli & Paolieri, 2008) assumed that the gender congruency effect in the picture-word paradigm depends on the specific, formal, morphosyntactic properties of

individual languages. Gender is an inherent lexical feature, but only in some languages it surfaces as nominal suffixes. In Italian almost all nouns have a complex morphological structure: Specifically, the ending vowel is itself marked for gender (Cantone & Müller, 2008) and allows distinguishing different nominal classes which act as paradigms for the morphological realisation of number forms (Corbett, 1991). Nominal endings are chosen as a function of grammatical gender; therefore, to access the noun's phonological form, the selection of the grammatical gender feature is crucial.

It follows that in producing bare nouns the gender congruency effect emerges because it reflects the processes underlying the selection of nominal endings. In Dutch, grammatical gender has important consequences for the form of the controlled words (i.e., the determiner) but not for that of the controlling nouns: Nouns are monomorphemic and not overtly marked for gender. Therefore, grammatical gender leads to no visible effects in bare noun production, semantic information being sufficient to access the target's phonological form.

In sum, according to this interpretation, the picture-word paradigm allows us to enlighten the syntactic operations underlying the overt manifestation of grammatical gender, but in bare noun production the effect is visible only in languages with nouns marked for gender. If this account were correct, the gender interference effect should be observed also in Spanish, a Romance language with a nominal gender system quite similar to the Italian one (Harris, 1991; Picallo, 2008). In Italian and in Spanish, most masculine nouns end with the vowel -o, whereas most feminine nouns end with -a (for example, "armadio/armario", cupboard, masc., and "sedia/ silla", chair,

fem., in Italian and Spanish, respectively). Further, in both languages many nouns end with the vowel -e, which is opaque for gender (e.g., "pettine/peine", comb, masc. and "chiave/llave", key, fem.), and a small set of nouns is defined as irregular for gender in both languages (i.e., "mano", hand, fem., and "gorilla", gorilla, masc.). Cubelli et al. (2005) assume that gender has to be selected to access the nominal ending, and this assumption is true for all nouns, although not every word in a language has these properties.

In the present research, bare noun production using the picture-word paradigm is further explored. The aim is to investigate the reliability of the gender congruity effect in Italian and to ascertain whether the effect could also be observed in Spanish.

EXPERIMENT 1

With the picture-word paradigm, Cubelli et al. (2005) reported on three experiments where the grammatical gender congruity and the semantic relationship between target and distractor nouns were orthogonally manipulated. Recently, Paolieri et al. (2009) replicated the effect in two new experiments where target and distractor nouns either shared the same or differed in their nominal endings. To ascertain whether the presence of distractors semantically related or morphologically different is a critical condition for the emergence of the effect, in this experiment we manipulated only the grammatical gender congruity of the target and distractor nouns, with all pairs being semantically unrelated and having the same nominal ending. This allowed us to use a larger set of stimuli. Further, as we assume that grammatical gender is specified as an abstract feature

within each lexical entry (Cubelli et al., 2005), an interference effect should be observed both when target and distractor nouns are morphologically marked for gender and when the suffixes in the target and distractor pairs are morphologically opaque (i.e., when grammatical gender cannot be derived from morphological information).

Method

Participants. Sixteen native Italian-speaking students at the University of Padova (mean age = 19 years, range 18-20 years), voluntarily participated in the experiment. They all had normal or corrected-to-normal vision.

Material. From the sets of Lotto, Dell'Acqua, and Job (2001) and Snodgrass and Vanderwart (1980), 48 pictures were chosen as targets and were presented as line drawings. Half of the target nouns was selected with the ending vowel -e that in Italian is opaque for grammatical gender, and the other half was selected with the ending vowels -a for the feminine and -o for the masculine, that in Italian are transparent for grammatical gender. Half of the target pictures had feminine names and half masculine names. Each picture was paired with a distractor noun of the same grammatical gender (congruent condition) and a distractor noun of different grammatical gender (incongruent condition). Congruent and incongruent conditions were created by reassigning the distractors from the congruent condition to different targets in the incongruent conditions. In all pairs, targets and distractors shared the same gender marker: Targets with a transparent ending vowel were associated to transparent distractors, targets with opaque ending vowel were associated to

opaque distractors (see Appendix A for the list of the target and distractor words).

The target and distractor nouns were matched for a number of variables. They did not differ (all *t*s < 1) for length, i.e., number of letters (transparent: 6.75 vs. 6.79; opaque: 6.08 vs. 5.96), frequency (transparent: 2.02 vs. 1.84; opaque: 1.96 vs. 1.73), familiarity (transparent: 4.96 vs. 5.27; opaque: 4.89 vs. 5.33), and age of acquisition (transparent: 3.11 vs. 3.48; opaque: 3.51 vs. 3.57). Moreover, congruent and incongruent pairs were matched for phonological overlap in percentage (transparent: 35.82 vs. 31.25; opaque: 34.12 vs. 35.66). The orthographic-phonological overlap was computed, taking into consideration the percentage of the number of letters shared by the target noun and the corresponding distractor word. For most stimuli, measures were taken from the corpora provided by Barca, Burani, and Arduino (2002), the Istituto di Linguistica Computazionale di Pisa (1988), and Lotto et al. (2001). For a small set of 11 stimuli, familiarity and age of acquisition were collected from 10 participants not involved in the experiment, using the same rating procedure employed by Lotto et al.

Procedure. The participants were tested individually, and were instructed to name each picture as quickly and accurately as possible, while ignoring the distractor word. The experimenter was seated behind the participant to record errors and equipment failures. At the beginning of the experiment, each participant was familiarized with the set of pictures. In this phase, the pictures were projected on the computer screen with a superimposed row of five Xs to simulate the distractor word; a feedback was given when the response deviated from the expected name.

Following the familiarization phase, a practice block of eight trials was administered. Finally, four experimental blocks of 24 trials were presented, for a total of 96 trials. Blocks were counterbalanced across participants. In each block, gender congruent and gender incongruent pairs, as well as transparent and opaque stimuli pairs, were evenly distributed. Within each block, trial randomisation was subjected to the following constraints: (a) the first two trials were fillers; (b) either congruent or incongruent pairs could appear in no more than three consecutive trials; (c) either transparent or opaque pairs could appear in no more than three consecutive trials; and (d) items belonging to the same semantic category could not appear in consecutive trials.

The stimuli were presented using E-Prime 1.1 (Psychology Software Tools, Inc., Pittsburgh, PA). When projected on the screen, pictures could be included in a virtual square of about 6x6 cm and were centred at fixation. The words, presented at the centre of the pictures at SOA 0, were shown in capital letters in 20-point Geneva font, bold. A trial consisted of the following events: a fixation cross, presented at the centre of the screen for 500 ms; the stimulus, which remained on the screen until the response or for a maximum of 2000 ms; a blank interval of 500 ms. Responses latencies were measured from the onset of the stimulus until the beginning of the response.

Results and Discussion

Four types of responses were excluded from the analyses: (a) naming errors; (b) verbal dysfluencies; (c) failures by the voice key to record the response; and (d) responses exceeding three standard deviations from the participant's mean. Overall, 10.02%

of the trials were excluded from the analyses. Mean RTs for correct responses are reported in Table 1. Separate analyses were carried out for participants and items, yielding F1 and F2 statistics, respectively. In the first ANOVA, grammatical gender (congruent vs. incongruent) and ending vowel (transparent vs. opaque) were the two within-subjects factors. The main effect of the grammatical gender was significant, revealing that gender congruent pairs led to longer naming latencies than gender incongruent pairs, F_1 (1, 15) = 78.55, MSE = 605.03, p = .0001; F_2 (1, 46) = 38.76, MSE = 1780.52, p = .0001. No effect of ending vowel was found, F_1 (1, 15) = 2.81, MSE = 844.39; F_2 (1, 46) = 0.259, MSE = 7424.11. The Grammatical gender x Ending vowel interaction was not significant, F_1 (1, 15) = 0.86, MSE = 1269.70; F_2 (1, 46) = 0.45, MSE = 1780.52.

In the second ANOVA, grammatical gender (congruent vs. incongruent), ending vowel (transparent vs. opaque) and stimuli type (masculine vs. feminine) were the three within-subjects factors. The main effect of the grammatical gender was significant, with gender congruent pairs slower than gender incongruent pairs, F_1 (1, 15) = 74.34, MSE = 1274.67, p = .00001; F_2 (1, 11) = 39.93, MSE = 1728.55, p = .0001. No effect of ending vowel and stimuli type were found, F_1 (1, 15) = 2.91, MSE = 1695.06; F_2 (1, 11) = 0.169, MSE = 11315.81; F_1 (1, 15) = 0.38, MSE = 1426.42; F_2 (1, 11) = 0.934, MSE = 11048.44. Moreover, the interaction of Grammatical gender x Stimuli type was significant, F_1 (1, 15) = 6.75, MSE = 1786.94, p = .020; F_2 (1, 11) = 4.93, MSE = 1607.63, p = .048. Grammatical gender effect was of 35 and 74 ms with feminine and masculine nouns, respectively. Analyses of simple effects showed that the effect of grammatical gender was significant for each stimuli type (Newman-Keuls

tests, $p < .05$). No interactions were found with the other variables.

Table 1| *Experiment 1 (Italian): Mean response latencies (in ms) and percentages of errors in the different experimental conditions.*

	Grammatical gender				
	Congruent		Incongruent		
Ending	Mean	E (%)	Mean	E (%)	Effect
Transparent	823	2.4	777	2.1	46
Opaque	844	2.5	781	3.1	63

Consistent with our previous findings (Cubelli et al., 2005; Paolieri et al., 2009), naming times to picture-word pairs sharing the same grammatical gender were slower than those to picture-word pairs with different gender. This is the first experiment where only the grammatical gender is manipulated, with the congruent and incongruent conditions being generated by reassigning the distractors to the targets. The interference effect of gender appears to be a very reliable phenomenon and was present both when the stimulus pairs were morphologically marked for gender and when they were morphologically unmarked. The Gender congruity x Ending vowel interaction is far from significant, but it is worth noting that the two different types of target were not balanced for a number of variables, and this could ascertain the larger effect that we observed in the unmarked condition relative to the marked condition.

If the gender congruency effect reflected the influence of grammatical gender in selecting the nominal endings, this effect should be detectable in another Romance language with a similar syntactic and morphological system, i.e., Spanish.

EXPERIMENT 2

Experiment 2 was conducted to ascertain whether the gender interference effect could also be observed with Spanish participants. Target nouns with transparent ending for gender (-o for masculine nouns, and -a for feminine nouns), coupled with morphologically transparent nouns as written distractors were used. Only nouns with transparent endings were employed, because unlike in Italian, in Spanish many nouns end in a consonant (e.g., "sol", sun, "mar", sea, "pez", fish), and the forms with final -e have consonants that are not normally permitted to occur in word final position. The -e provides syllabicity for the consonant which precedes it and which do not occur in final position (Stockwell, Bowen, & Martin, 1965). Moreover, at variance with Italian, most words ending with -e are masculine (Teschner & Russell, 1984).

Method

Participants. Twenty native Spanish-speaking students at the University of Granada (mean age = 23 years, range 20-26 years), voluntarily participated in the experiment. They all had normal or corrected-to-normal vision.

Material. From the database of Lotto et al. (2001) and Snodgrass and Vanderwart (1980), 28 pictures were chosen as targets and presented as line drawings. Half pictures had feminine names ending in -a, and half had masculine names ending in -o. Therefore, all target nouns were morphologically transparent for gender. As in Experiment 1, each picture was paired with a distractor noun of the same grammatical gender (congruent condition) and a distractor noun of different grammatical gender (incongruent condition). Both conditions are formed by

assigning each distractor to different targets in the congruent and incongruent conditions. In each condition all the distractor nouns were marked for gender, i.e., they had the masculine vowel -o and the feminine vowel -a (transparent ending). All target-distractor pairs were semantically unrelated. The names of the target and distractor pairs were matched (all *t*s < 1) for length (5.89 vs. 6.39) and frequency (1.49 vs. 1.36; Alameda & Cuetos, 1995). Moreover, congruent and incongruent pairs were matched phonological overlap (in percentage: 32.17 vs. 25.79). The list of the stimuli is reported in Appendix B.

Procedure. Procedure and analyses were the same as those used in Experiment 1.

Results and Discussion

Using the same exclusion criteria of Experiment 1 led to 11.8% of the trials being excluded from the analyses. Grammatical gender (congruent vs. incongruent) was the within-subjects factor. The main effect of the grammatical gender was significant, F_1 (1, 19) = 18.60, MSE = 822.73, p = .0004; F_2 (1, 27) = 8.81, MSE = 1978.76, p = .006, revealing again that responses to gender congruent pairs were slower than those to incongruent pairs. Mean RTs for correct responses are reported in Table 2.

In the second ANOVA grammatical gender (congruent vs. incongruent) and stimuli type (masculine vs. feminine) were the two within-subjects factors. The main effect of the grammatical gender was significant, with gender congruent pairs slower than gender incongruent pairs, F_1 (1, 19) = 18.77, MSE = 1669.60, p = .0004; F_2 (1, 13) = 9.70, MSE = 1797.58, p = .008. The main effect of stimuli type was significant in the analysis by subjects, but not in the analysis by items, F_1 (1, 19) = 9.30, MSE = 1988.29; F_2 (1,

13) = 2.38, *MSE* = 5298.65, revealing that feminine nouns were produced significantly slower than masculine nouns. The Grammatical gender x Stimuli type interaction was not significant, F_1 (1, 15) = 0.86, *MSE* = 1269.70; F_2 (1, 13) = 0.24, *MSE* = 2270.59, indicating that comparable patterns of results were observed across masculine and feminine nouns.

In Experiment 2, the interference effect of grammatical gender was replicated. Again, RTs to congruent target and distractor pairs were slower than RTs to incongruent ones. For the first time, the effect has been found in a language other than Italian.

Table 2 | *Experiment 2 (Spanish): Mean response latencies (in ms) and percentages of errors in the different experimental conditions.*

	Grammatical gender				
	Congruent		Incongruent		
Ending	Mean	E (%)	Mean	E (%)	Effect
Transparent	803	6.7	764	5.1	39

GENERAL DISCUSSION

Using the picture-word paradigm we were able to replicate the gender interference effect in bare noun production not only in Italian but also in Spanish, a language with a similar morphological system. These experimental findings constitute further evidence in supporting the notion that grammatical gender is an intrinsic lexical property and not a pure syntactic feature to be processed only in noun phrase production, and are consistent with the hypothesis that the gender congruity effect in Italian and Spanish reflects the access to the appropriate nominal

ending which depends on the selection of the grammatical gender. The notion that grammatical gender is also selected in bare noun production and that its influence can be detected using the picture-word paradigm is supported by a recent study with French participants (Alario, Ayora, Costa, & Melinger, 2008).

The interference due to gender congruency can be accounted for by postulating that active inhibition of the lexical representation of the distractor noun spreads to the lexical representation of the target. Due to its orthographic format, the lexical representation of the distractor receives activation from two different sources: Semantics and orthography-to-phonology mechanisms. Hence, the lexical representation of the written distractor noun reaches a level of activation which is higher than that of the target noun (Cubelli & Paolieri, 2008). To select the target noun and to accomplish the task, the more activated distractor word must be suppressed (for similar accounts, see the response exclusion hypothesis proposed by Mahon et al., 2007, and the active inhibition hypothesis advanced by Colzato et al., 2008). This operation slows down response times, but in Romance languages the active inhibition of the gender information of the distractor noun would cause additional delay if the target noun has the same grammatical gender. Accordingly, the interference effect found in Romance languages like Italian and Spanish, reflects the delayed selection of the ending vowel due to the inhibition of the gender feature of the distractor representation.

Alternatively, the interference effect of gender congruency can be interpreted assuming competition for selection. When one lexical representation is activated, it spreads activation to other representations in the lexical network as a function of their

similarity: The more similar the lexical representations are at the semantic or the syntactic level, the more they activate each other. According to the double-competition model (Cubelli et al., 2005), a lexical entry is first selected in a semantically specified form, and then the lexicosyntactic representation containing information about grammatical gender is also selected. During semantic selection competitors are activated by virtue of their belonging to the same category, similarly during syntactic selection, competitors are activated by virtue of their belonging to the same gender class.

At variance with Italian and Spanish, the gender congruity effect has never been observed in Dutch (La Heij et al., 1998; Starreveld & La Heij, 2004), where no inflection has to be selected for the production of bare nouns. Grammatical gender is crucial to select determiners and adjectival inflections, but it does not surface as nominal endings. Consider for instance the Dutch words ‘‘stoel’’, chair, common gender and ‘‘huis’’, house, neuter gender: Their grammatical gender is marked either by the determiner (‘‘de stoel’’, ‘‘het huis’’), or by the different form of the adjectives (‘‘groene stoel’’, green chair, ‘‘groen huis’’, green house). The selection of the noun’s phonological form depends only on semantic information: Therefore, in the picture-word paradigm the delayed selection of grammatical gender of the target has no visible effects on bare noun production.

In conclusion, the selection of nominal gender appears to be mandatory even in bare noun production. The processing of grammatical gender as a lexical feature is supported by universal mechanisms but the experimental effects vary according to the constraints imposed by language-specific properties.

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CHAPTER IV

Experiments 3, 4 and 5

The gender congruency effect during bilingual spoken-word recognition*

Grammatical gender is a lexical property of nouns that can cause facilitation or interference during bilingual speech production. Although this so-called "gender-congruency effect" is robust for production, few studies have examined its presence during bilingual spoken-word recognition. We investigate the gender-congruency effect during an on-line comprehension task using the Visual World paradigm. The eye movements of Italian-Spanish bilinguals and Spanish monolingual speakers were monitored while they viewed a pair of pictured objects on a computer screen. Participants listened to instructions in Spanish (encuentra la bufanda/find the scarf) and clicked on the object named in the instruction. Grammatical gender of the objects' name was manipulated, so that each pair either did or did not share gender in Italian (Congruent and Incongruent conditions, respectively), but always shared gender in Spanish. Results showed that bilinguals, but not monolinguals, looked at the target object fewer when it was incongruent in gender, suggesting a between-language gender competition effect. In addition, bilinguals looked at the target picture more when the definite article in the speech instructions provided a valid cue to anticipate its selection (different-gender condition). The temporal dynamics of gender processing and cross-language activation in bilinguals are discussed.

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An important feature of the bilingual brain is the ability to control two or more languages and to select the language that is appropriate for a particular context. Most bilingual models agree on the existence of a unique conceptual representation for the two languages that is matched with two different lexical entries (De Groot, 1993; Kroll & Stewart, 1994). For instance, the concept of *snail* would be linked to the lexical representation *lumaca*$_{(FEM)}$ in Italian and *caracol*$_{(MASC)}$ in Spanish, for an Italian-Spanish bilingual. Moreover, most studies provide evidence that the two languages are simultaneously activated in the bilingual mind, and that the linguistic properties of the non-intended language affect both the production and comprehension of the intended language at the semantic, phonological and grammatical levels (e.g., Blumenfeld & Marian, 2007; Colomè, 2001; Costa, Caramazza, & Sebástian-Gallés, 2000; Hoshino & Thierry, 2011; Ju & Luce, 2004; Paolieri, Cubelli, Macizo, Bajo, Lotto, & Job, 2010; Weber & Cutler, 2004).

Grammatical gender is an inherent property of nouns that controls agreement phenomena within and outside the noun phrase (Corbett, 1991). The results of many experiments suggest that this property is activated and interacts in the two lexical systems of bilingual speakers during production (e.g., Bordag & Pechmann, 2007, 2008; Lemhöfer, Spalek, & Schriefers, 2008; Paolieri et al., 2010; Salamoura & Williams, 2007). Although evidence regarding gender effects during bilingual comprehension is scarcer, a number of studies have also shown that the two languages of the bilinguals interact at this level. For instance, in the first experiment reported by Lemhöfer et al. (2008), German-Dutch bilinguals were asked to perform a lexical decision task in their L2 in which grammatical gender was

manipulated between languages. Each target noun was preceded by its correct gender-marked determiner. Results showed that participants were slower for words whose gender was incongruent with their German translations, suggesting that grammatical gender interacts between languages during word recognition.

Additionally, other studies in bilingual comprehension and production (e.g., studies using translation tasks) have shown that gender interactions are also present in other languages with gender marked systems. In this way, Salamoura and Williams (2007) found that Greek-German bilinguals were slower translating words from L1 to L2 when words did not share gender in the two languages (but only when gender agreement between a noun and an adjective was required). Paolieri and colleagues (2010, Experiment 3) also found similar results when Italian-Spanish participants were asked to translate words from L1 to L2 (both for bare noun translation and article + noun combinations). These results imply a gender integrated view in bilinguals, either because there is a single integrated gender system (Salamoura & Williams, 2007) or because the lexical representations that specify grammatical gender are linked (Paolieri et al., 2010).

Because grammatical gender behaves as an important morpho-syntactic cue to identify words and build syntactic representations in real time (e.g., Wicha, Moreno, & Kutas, 2004), one should expect some influence of the native gender information in bilinguals when they comprehend in their second language. However, there might be some differences depending on whether comprehension is visual (e.g., written-word recognition) or auditory (e.g., speech recognition). According to

the dual route proposed by Gollan and Frost (2001), grammatical gender can be accessed from two independent routes. The first one originates from the marked morpheme of nouns, which is represented at the word form level. The second one derives from an abstract route, at a lexical level, independently of any morphological gender marker, and it is ultimately given priority over the first route. Thus, written words allow participants to rapidly access gender information using mainly a form route. In contrast, spoken word recognition forces participants to access gender representation of nouns using a lexical route. Hence, it is theoretically relevant to investigate possible between-language gender interactions both during bilingual reading and during spoken comprehension. However, the few studies focusing on grammatical gender and bilingual comprehension have used lexical decision tasks, and evidence regarding how gender is integrated during on-line spoken language comprehension in bilinguals is very scarce[5]. The purpose of this study is to explore how grammatical gender interacts in a spoken-word recognition task in Italian-Spanish bilinguals by using an eye tracking

[5] Weber and Paris (2004) have already made the attempt to investigate how grammatical gender interacts in bilingual spoken comprehension. In a preliminary study, French-German bilinguals were presented with L2 auditory questions while looking at a display showing several objects. The pattern of fixations revealed that, when target and competitor shared gender in German-L2 but not in French-L1, early fixations to competitor pictures were reduced. However, the authors mixed grammatical gender and phonology in the selection of materials, an important aspect that strongly restricts our understanding of how grammatical gender interacts during bilingual comprehension. Furthermore, the control group included participants that had previously learned French as L2, and not a group of real monolingual speakers. Additionally, material descriptions and some other information are not provided in depth.

technique. We aim to determine whether gender information of the native language affects auditory comprehension in L2 and to explore the time course of on-line integration of gender information during spoken word recognition in bilinguals.

The use of eye-tracking along with spoken language instructions and visual displays enables us to examine the mental processes that accompany spoken language comprehension (e.g., Allopenna, Magnuson, & Tanenhaus, 1998; Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995). The typical *visual world* task consists of a display showing several objects in a visual workspace while participants follow spoken instructions to pick up or move one of the objects (see Huettig, Rommers, & Meyer, 2011, for a review). Given that eye movements provide a measure of speech comprehension closely time locked to the speech signal input, we can draw inferences about comprehension processes by analyzing the time course of reference resolution and the pattern of fixations to potential referents in the visual display (Tanenhaus, Magnuson, Dahan, & Chambers, 2000).

Spivey and Marian (1999) have used the visual-world paradigm to examine language co-activation at the phonological level in bilinguals during a spoken-word recognition task. Results showed that English-Russian participants looked at the picture of a *marker* when hearing the Russian word *marku* (stamp) more often than at distractor objects because of the phonological similarity between languages. This pattern suggests that bilingual listeners do not deactivate their alternative language when involved in a comprehension context (Marian & Spivey, 2003a, 2003b) and supports the idea that the two languages of a bilingual are connected at the phonological level.

The visual world procedure has also been used to study grammatical gender processing in monolingual contexts (Dahan, Swingley, Tanenhaus, & Magnuson, 2000). Dahan and collaborators found that lexical activation of targets and distractors during a visual world task was modulated by the grammatical gender information of the nouns. In their experiment, French speakers were presented with a display showing four pictures and were given a spoken instruction to click on one of them (e.g., *cliquez sur le*$_{(MASC)}$ *bouton*$_{(MASC)}$ –click on the button–). The objects included a target (*bouton*$_{(MASC)}$ –button–), a cohort competitor (i.e. a name which shares the same initial onset and vowel; *bouteille*$_{(FEM)}$ –bottle–), and two distractors. Previous studies have shown that the latency in looking at the target picture is longer when there is a cohort competitor in the visual workspace (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1996). However, Dahan et al. (2000) found that this cohort effect was eliminated when a gender-marked article preceded the target word, thus preventing the early activation of nouns inconsistent with that gender (gender-mismatching phonological competitors).

Similarly, a recent visual-world study with bilinguals has shown that Italian native speakers are also able to exploit the grammatical gender information provided by the definite articles when interpreting speech utterances in their second language (Dussias, Kroff, Guzzardo, & Gerfen, 2013), providing strong evidence about the importance that this feature has on the processing of the second language in bilinguals. In short, the ability to process grammatical gender seems to be crucial in order to facilitate the interpretation of the speech. Moreover, this capacity is not restricted to adults, since several studies have

found that children from 24 months are also faster orienting to the referent target in a visual-world scene when there is a mismatch in the grammatical gender of the pictures (Lew-Williams & Fernald, 2007; van Heugten & Johnson, 2011; van Heugten & Shi, 2009).

The present study

Given that grammatical gender is a property of nouns that has been shown to interact and cause interference in bilingual speakers (Lemhöfer et al., 2008; Paolieri et al., 2010; Salamoura & Williams, 2007), we might expect the same type of connections and influences within an on-line spoken word recognition context. This prediction would follow, if as assumed by dual models (Gollan & Frost, 2001), gender representation derives not only from gender-marked morphemes, but also from the lexical level. If this were the case, incongruent gender-marked nouns might be expected to modulate the interpretation of noun-phrases in a spoken word recognition task. Because little is known about cross-language gender effects in on-line spoken comprehension contexts, we decided to work with two Romance languages with similar gender systems (Italian and Spanish), while making critical use of nouns whose gender representation differs between the two. Gender processing in these two languages has previously been shown to interact in language production contexts (Paolieri et al., 2010). However, there are no studies exploring how the congruence or incongruence in gender between these two languages affects L2 processing in spoken language comprehension. In two visual world studies, we manipulated the L1 gender congruency of the pictures to explore whether Italian learners of Spanish were affected by the gender

representations of their native language when interpreting spoken instructions in the L2.

EXPERIMENT 3

Using a similar procedure to the visual world task, Italian-Spanish speakers were provided with pairs of pictures that did or did not share grammatical gender in Italian, but that always shared gender in Spanish. Concurrently, participants heard a Spanish sentence and were instructed to click on the named picture (*encuentra la*$_{(FEM)}$ *bufanda* –find the scarf–) while their eye movements were recorded. If both languages are active in bilinguals and L1 grammatical gender affects the spoken language processing of L2 noun-phrases, we should observe a diminished proportion of fixations as a function of time to the target pictures in incongruent gender trials relative to gender congruent trials.

Method

Participants. Thirty-two Italian-Spanish proficient bilinguals with a mean age of 27 years (SD = 4.48) volunteered to participate in the experiment. Spanish proficiency was assessed through a self-rated subjective questionnaire administered at the end of the experiment proper (see Table 3 for a description of the participants).

Design and materials. The main task of the experiment consisted of an on-line spoken-word recognition task using a visual world procedure. The participants were presented with a visual display showing two pictures and heard an instruction in Spanish asking them to click on the named picture. Meanwhile, their eye movements were recorded.

Table 3 | *Language history and self-evaluated proficiency scores of the Italian-Spanish bilinguals in Experiment 3 and 4.*

	Exp. 3	Exp. 4
Age (years)	27.28 (4.48)	28.68 (6.27)
Language history*		
Use of L2 (years)	4.94 (4.36)	4.63 (4.32)
Length of immersion (years)	3.67 (3.53)	3.80 (3.34)
Self-evaluated proficiency level questionnaire in L2**		
Production	7.94 (1.26)	8.33 (1.56)
Comprehension	8.59 (0.87)	8.69 (1.11)
Writing	7.39 (1.46)	8.04 (1.73)
Reading	8.28 (1.36)	8.87 (1.11)

***Note: The scores are on a 10-point scale, in which 10 represents native-speakers level and 1 complete lack of knowledge of the language. Mean are shown with corresponding standard deviations in parentheses.*

Seventy-two pictures were selected from Lotto, Dell'Acqua, and Job (2001), half with masculine names and half with feminine names for Italian and Spanish. Of these, 60 pictures had names whose gender was congruent between the two languages (e.g., *sciarpa*$_{(FEM)}$ and *bufanda*$_{(FEM)}$ –scarf–) and 12 pictures had names whose gender was incongruent (e.g., *letto*$_{(MASC)}$ and *cama*$_{(FEM)}$ –bed–). This gender-distribution of items was constrained by reasons related to the experimental design (a complete list of the stimulus materials is provided in Appendix C).

Two experimental conditions were created (congruent vs. incongruent; see Figure 12 for a sample of the conditions). The *congruent condition* included pairs of pictures whose names shared grammatical gender in Italian (*sciarpa*$_{(FEM)}$ and *mela*$_{(FEM)}$ – scarf and apple, respectively–). The *incongruent condition*

included pairs of pictures whose names had different grammatical genders in Italian (e.g., *scimmia*$_{(FEM)}$ and *cappello*$_{(MASC)}$ –monkey and hat, respectively–). It is crucial to note that all pictures in the two conditions shared grammatical gender in Spanish (in the previous examples, *bufanda*$_{(FEM)}$ and *manzana*$_{(FEM)}$, for the congruent condition; *mono*$_{(MASC)}$ and *sombrero*$_{(MASC)}$ for the incongruent condition). Thus, any differential effects in the pattern of fixations found between the congruent and incongruent conditions should be attributable to the activation of the different Italian gender representations of target items.

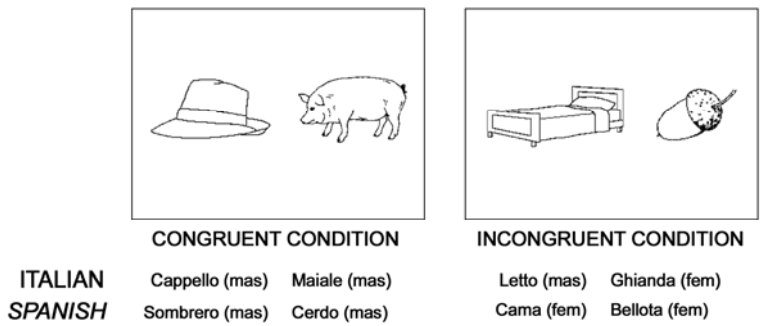

Figure 12 | *Example of pairs of pictures across conditions.*

Additionally, we introduced filler pairs that were composed of pictures with different genders in Spanish (the language of presentation) in which each member of the pair also shared the gender of its Italian translation equivalent (e.g., *aereo*$_{(MASC)}$ and *arancia*$_{(FEM)}$ in Italian; *avión*$_{(MASC)}$ and *naranja*$_{(FEM)}$ in Spanish – plane and orange, respectively–). The 72 nouns used in the experiment were controlled for frequency in Spanish and Italian (Alameda & Cuetos, 1995 for Spanish; and Bertinetto et al., 2005 for Italian) and number of letters (all *t*s < 1). Translations of the

pictures' nouns were also matched for overall phonological overlap for the two experimental conditions. This was computed taking into consideration the percentage of the number of letters shared by the two pictures' nouns in Italian and Spanish for each condition. Finally, target and distractor pictures in each pair, as well as location of the picture on the screen (left or right), was counterbalanced across participants. All of the 36 pairs (equally distributed among conditions) were presented once and in a random order during the whole experiment.

For the speech instructions, 36 Spanish sentences were recorded, always using the same structure: "encuentra" + "definite article *el*$_{(MASC)}$ or *la*$_{(FEM)}$" + "target noun" (e.g., *encuentra la bufanda,* –find the scarf–). The sentences were produced using standard, broad focus intonation (i.e., no narrow focus or other emphasis was produced on any of the target noun phrases). Because we wanted to explore between-language interactions in a spoken word recognition task, controlling the onset and duration of the definite article in the sentences was critical. For this reason, the article preceding the target noun in each selected sentence was hand-edited to a duration of 147 ms, followed by a blank space of 50 ms using the Praat Software (www.praat.org). Duration of the word *encuentra* was also hand-edited to 800 ms. In this way, the duration of the acoustic signal conveying grammatical gender prior to the onset of the target noun was identical across all items.

Procedure. Participants were tested individually in a quiet room. Before taking part in the experiment proper, participants completed a familiarization task, which included the 72 pictures used in the experiment. During this phase, participants were

instructed to name each picture in Spanish together with its corresponding definite article (i.e., *el*$_{(MASC)}$ or *la*$_{(FEM)}$). This was done to ensure that the bilingual participants were able to assign the correct Spanish name to each picture and also to ensure that they knew the correct gender value of the nouns in Spanish. Participants were provided with the correct response in case an error was made. Overall, the mean naming error percentage (i.e. production of names other than expected) was 11.71%; and the mean gender error (i.e. production of the incorrect gender-marked article) was 0.65%. Pictures incorrectly named during this phase by the participants were not included in the data analysis of the eye tracking phase. The stimuli were presented using E-Prime experimental software, version 1.1 (Schneider, Eschman, & Zuccolotto, 2002). This phase lasted about 5 minutes after which participants started the spoken-word recognition task.

Participants' eye movements were recorded using an Eyelink 1000 eyetracker (SR Research, Ontario, Canada). Viewing was binocular but eye movements were recorded from one eye only. Stimuli were presented on a color 17-inch ViewSonic 17PS monitor, with participants seated 65 cm from the monitor and resting their chins comfortably on a chin rest. Sampling rate was 500 Hz. Calibration was checked on each trial and spatial resolution was better than 0.5 degrees. To begin each trial, participants looked at a fixation point in the center of the computer screen. Subsequently, two pictures appeared on the screen and 500 ms later the speech signal started to play. Participants were instructed to click on the picture named in the sentence. The pictures had a dimension of 168 x 168 pixels and were located at a distance of 192 pixels from each other. Before

starting, participants completed a practice phase with 8 trials including pictures that were never presented during the experimental session. The entire data collection procedure lasted about 20 minutes including the calibration and practice phase. At the end of the experiment, the subjective questionnaire evaluating L2 proficiency was administrated.

Data analysis. Fixations were automatically defined by the eye tracker using the detection algorithm supplied by SR Research and were calculated online by the eye tracker software. The analysis conducted for the comprehension task included the proportion of target fixations through the different conditions in time windows of 50 ms from article onset (see Dahan et al., 2000, for a similar procedure). Fixations were coded as pertaining to the target- or distractor picture area (interest areas were delimited by the complete square area occupied by the pictures). Saccade times as well as blinks were not added to fixation times, and fixations out of interest areas were not considered for the analysis.

Results and Discussion

Errors selecting the correct picture were excluded from the final data analysis (overall, 0.26% of the total of trials). Then, we defined a time window extending from 200 to 900 ms after article onset to compare the proportion of target fixations in the Congruent and Incongruent condition. This frame starts with the time that an eye movement takes to be launched by the definite article in the speech signal (Matin, Shao, & Boff, 1993), and ends with the target selection, i.e. at the moment in which the differences between conditions seem to disappear (see Figure 13). The ANOVA on the mean proportion of target fixations on the

different temporal windows revealed a significant interaction between Condition (congruent vs. incongruent) and Temporal window (14 different frames of 50 ms covering from 200 to 900 ms) [F (13, 403) = 4.331, MSE = 363.417, p = .007]. Thus, to examine the moment in which the congruent and incongruent conditions begin to diverge from each other, we performed a series of t-test over successive 50 ms - temporal windows. Planned comparisons revealed significant differences on the proportion of target fixations between Congruent and Incongruent trials at the time window of 500 ms from article speech signal [t (31) = 3.390, p = .002], and this difference remained significant until the end of the trial across all 50 ms – time windows (all p's < .05).

This result indicated that the presence of an Italian-Spanish incongruent gender noun influenced the fixations on the target picture. Specifically, when bilingual participants were asked in their L2 to find a picture in a display, they exhibited a lower proportion of looks over time to the target item when the trial involved a target picture whose translation equivalents in Italian and Spanish have distinct genders[6]. Importantly, although the task was performed in Spanish only (the L2), the activation of Italian gender (i.e. the gender of the name of the picture in the L1) modulated the pattern of eye fixations over time. This result suggests that bilinguals are not exempt from the influences of

[6] In order to consider the possible impact of the phonological similarity between Italian and Spanish feminine determiners ($la_{(FEM)}$), an additional ANOVA including gender (masculine and feminine) and condition (congruent and incongruent) revealed no interaction effects [F (1, 62) = .554, p = .45]. Thus, the similarity between the feminine definite article in the two languages did not influence the obtained pattern of results.

their native-gender knowledge when listening to speech in their L2 given that items that did not share gender across languages yielded a reduced proportion of fixations on target pictures relative to target items in the congruent gender condition. This pattern of fixations suggests that the coactivation of the two conflicting gender representations for incongruent items led to a reduction in the validity of the gender cue provided by the Spanish article in the auditory stream. That is, the reliability of gender as a cue to identify the appropriate target was reduced.

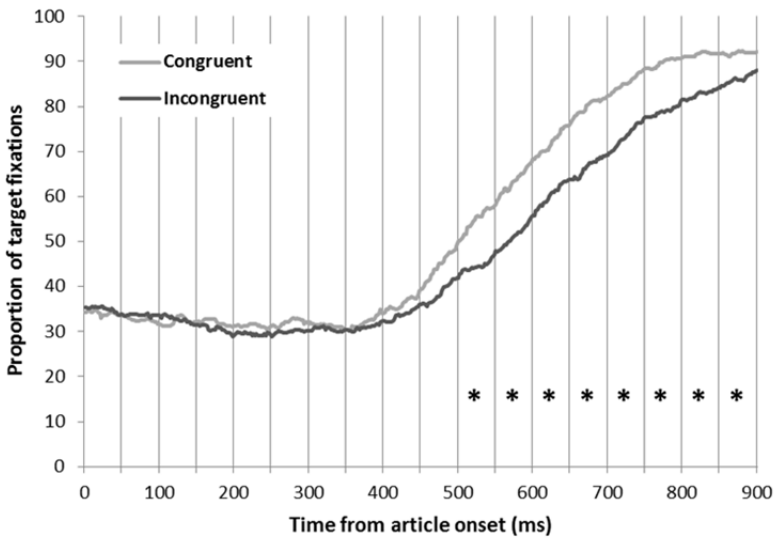

Figure 13 | *Total proportion of fixations to target pictures from article onset for Italian-Spanish bilinguals in Experiment 3. The symbol (*) represents the temporal window in which grammatical gender effect (congruent vs. incongruent) is significant.*

However, it could be argued that several aspects of our procedure and design might have affected our results: 1) the presence of a familiarization phase, in which the pictures were presented along with their corresponding definite articles, may have induced a

gender-centered processing mode in the subsequent eye tracking session that could have otherwise be absent; 2) due to the nature of the manipulation, the distractors in the congruency manipulation could not be counterbalanced, and different set of pictures were used as distractors in the two conditions of the experiment. Although, the distractors in the two conditions were carefully matched, the fact that they were different pictures may have biased the results. Thus in Experiment 4, we removed the familiarization phase and used the same distractors for each of the experimental conditions.

In addition, Experiment 4 explores the temporal dynamics of the gender congruency effect. As mentioned earlier, the gender congruency effect was significant at about 500 ms from article onset in the speech signal. However, we know that programming an eye movement typically takes 150-200 ms before it is launched (Matin et al., 1993), and therefore, the gender effect should have been observed approximately 150-200 ms after target onset (i.e. at about 350 ms from article signal). Several reasons may have produced this delay in the effect. First, it is possible that, although previous evidence suggests that bilinguals are able to exploit gender cues to select the correct target (Dussias et al., 2013), L2 gender processing might be generally slow, and gender effects are not evident from the article onset but only when the noun unfolds in the sentence and participants have enough information to select the correct picture on the display. Moreover, it is also possible that gender processing might start upon the article presentation, but gender co-activation may take more time and gender congruency effects may have not been evident until later in the sentence. In this sense, when we inspected the results of the filler trials (i.e. pairs of different-

gender pictures in the two languages) we observed that the amount of fixations to the referents started to increase at the time of 200 ms from the article signal. This is because the definite articles become a potential cue to identify the target pictures in advance (Dahan et al., 2000; Dussias et al., 2013). This would lead to the suggestion that the between-language gender interference of our results could be also originated from the onset of the definite article. However, because these items were not well controlled for in terms of their lexical variables, and because the gender effects appeared so late in the pattern of fixations, we cannot be sure about the moment in which the gender effect arises.

To explore the temporal dynamics of the gender congruency effect, in Experiment 4 we introduced a new condition (different gender condition) to determine whether L2 gender processing was taking place from the article onset where gender information was presented first. The comparison between different-gender trials (where the definite articles is an informative cue for interpreting speech) and same-gender trials (i.e., Congruent and Incongruent condition; where the articles are less informative), would provide us important information about the moment in which the gender effect appears.

Finally, it is possible that not only the gender information, but some further acoustic or orthographic information could have influenced the pattern of fixations in Experiment 3. Crucially, although we controlled for phonological overlap between conditions as a whole, such that the congruent and incongruent conditions were matched, some words remained that shared

orthographic overlap between languages[7]. Therefore, the presence of these words may have influenced our results and produced slower fixations (Allopenna et al., 1998). Hence, we created a new set of materials so that target and distractor nouns never shared orthographic features or had similar phonological onsets across translations. If the same pattern of results is obtained, we should be more confident in generalizing our results.

EXPERIMENT 4

In Experiment 4, Italian-Spanish bilinguals were required to perform a spoken-word recognition task similar to that used in the previous study. First of all, we aimed to replicate the pattern of findings we observe in Experiment 3, with bilingual speakers being influenced by their native gender knowledge while interpreting speech utterances in their L2. In Experiment 4 care was taken that the experimental materials did not contain phonologically-related words between languages and that target and distractor nouns never shared orthographic onset in any of the languages. We expected to obtain results similar to those obtained in Experiment 3 (gender congruency effects) even though possible biasing factors related to the materials and procedure were removed.

But, more importantly, in Experiment 4 we wanted to explore the temporal dynamics of the gender congruency effect by including a well-controlled different-gender condition. In this way, a recent

[7] e.g., Cereza-Ciliegia (cherry); Taladro-Trapano (powerdrill); Ojo-Occhio (eye); Lobo-Lupo (wolf); Manzana-Mela (Apple); Pelota-Palla (ball); Silla-Sedia (chair); Clavo-Chiodo (nail); Bolo-Birillo (bowl).

study by Dussias and colleagues (2013) has shown that Italian learners of Spanish can benefit from the processing of the determiner articles to anticipate upcoming nouns during L2 sentence interpretation. Using a visual world procedure, participants were presented with pairs of pictures that shared or did not share gender. Their results evidenced that when both pictures differed in gender, bilingual speakers used the gendered articles to anticipate the selection of the target pictures. However, when the nouns of the two pictures shared the same gender, speakers waited to hear the onset of the noun to correctly select the appropriate target. Note that this different-gender condition corresponds to our filler condition in Experiment 3. Therefore, in Experiment 4 we controlled for the lexical variables concerning these items and included them as an additional experimental condition (the so-called different-gender condition). With this scenario, we should be able to explore whether the gender effects could be linguistically driven by the gender information encoded in the definite articles or, in contrast, they occur at some time later in the speech processing.

To summarize, in the same-gender trials (i.e. Congruent and Incongruent conditions) we expected to replicate the pattern of results observed in Experiment 3, with less proportion of fixations to the target picture when it was incongruent in gender between Italian and Spanish. Moreover, we expected that trials where the definite article provided enough information to anticipate the upcoming noun (i.e. different-gender condition) would be relatively facilitated compared to trials where this information was not present (i.e. same-gender trials). That is, we expected that the presence of the determiner in the different-gender trials would produce more and faster fixations than the

trials where the nouns of the two pictures were similar in gender, but differed across trials on whether they had congruent or incongruent genders between languages. Finally, we were interested in comparing the time courses of the two gender effects: same-different gender trials and congruent-incongruent gender translations. The first would indicate the moment when L2 determiner gender processing starts, while the second would signal the moment in which L1 language co-activation occurs. Hence, this comparison would provide us important information about the moment in which the gender processing and gender co-activation occurs.

Method

Participants. A new group of 26 Italian-Spanish proficient bilinguals voluntarily participated in this experiment (mean age of 28 years, *SD* = 6.27). The Spanish proficiency was measured through a self-rated subjective questionnaire at the end of the session proper (see Table 3 for a description of the participants).

Design and materials. We selected 70 pictures from Snodgrass and Vanderwart (1980), half with feminine nouns and half with masculine nouns for Italian and Spanish. Of these, 42 were congruent in gender between the two languages and 28 were incongruent (see Appendix D). Three conditions were created: Congruent, Incongruent, and Different-gender trials. In Experiment 2 each condition was composed of 14 different target-distractors picture pairs. While the target pictures varied among conditions and defined them, the distractors were the same across the three conditions so that any between-condition effect could not be attributable to presence of different distractors. To avoid expectancy effects due to the repeated role

of the same pictures as distractors, we created filler trials where these pictures acted as targets. The nouns of the 42 experimental pairs were controlled for frequency in Spanish and Italian (Alameda & Cuetos, 1995 for Spanish; and Bertinetto et al., 2005 for Italian) and number of letters (all *t*s < 1) across conditions. Care was taken to exclude cognate words, and pictures that shared the initial phoneme in Spanish or Italian. Finally, the location of the pictures on the screen was counterbalanced across participants and the 70 trials were randomly presented during the whole experiment.

For the instructions, 70 Spanish sentences were recorded using always the same structure "encuentra + article + noun". In this case, duration of the word *encuentra* was hand-edited to 730 ms, followed by the definite article with a duration of 200 ms. Finally, a blank space of 50 ms preceded the speech signal of the target noun.

Procedure. The procedure was similar to that used in Experiment 3 with the only exception that we removed the familiarization phase.

Results and discussion

The process for calculating the mean percentage of target fixations through the different temporal windows of 50 ms was identical to that used in Experiment 3. Errors selecting the correct picture were removed from the final analysis (overall, 1.65% of the total of trials). Then, we defined a temporal window starting at 200 ms from article onset and ending at 850 ms with the target selection (i.e. when the differences across conditions tend to vanish; see Figure 14). The ANOVA on the mean proportion of target fixations revealed a significant interaction

effect with Condition (Congruent, Incongruent, and Different-gender) and Temporal window (13 different 50ms-frames ranging from 200 to 850 ms) as within-subject factors [F (24, 600) = 2.503, MSE = 74.023, p = .0001]. Thus, in order to examine the moment in which the different conditions begin to diverge from each other, we performed t-test analyses over successive 50 ms temporal windows. Gender congruency effects (congruent vs. incongruent condition) were significant at the time windows of 350 ms and 400 ms [t (25) = 2.039, p = .05; t (25) = 2.137, p = .04; respectively], and this effect disappeared at 450 ms onward (all p's > .05). Therefore, bilingual speakers were again influenced by the gender of their L1 when performing a spoken word recognition task in L2[8]. Because the nouns in these conditions never shared orthographic and phonological overlap between Italian and Spanish and all aspects of the procedure were carefully matched, only the grammatical gender value of the nouns could explain the lower proportion of target fixations in the incongruent condition. Thus, conditions in which the translation equivalent nouns in Italian and Spanish for the target picture shared the same gender exhibited an increased proportion of target fixations relative to the incongruent condition. Similarly to Experiment 3, we argue that the smaller proportion of fixations to the incongruent nouns can be interpreted as indexing the coactivation of the two gender systems, a situation that led to a reduction of the cue validity of

[8] The analysis of variance did not show interaction effects between gender (masculine and feminine) and condition (congruent and incongruent) [F (1, 50) = .667, p = .28], indicating that the gender of the target nouns did not influence our results.

the spoken Spanish determiners during the speech instruction for incongruent items.

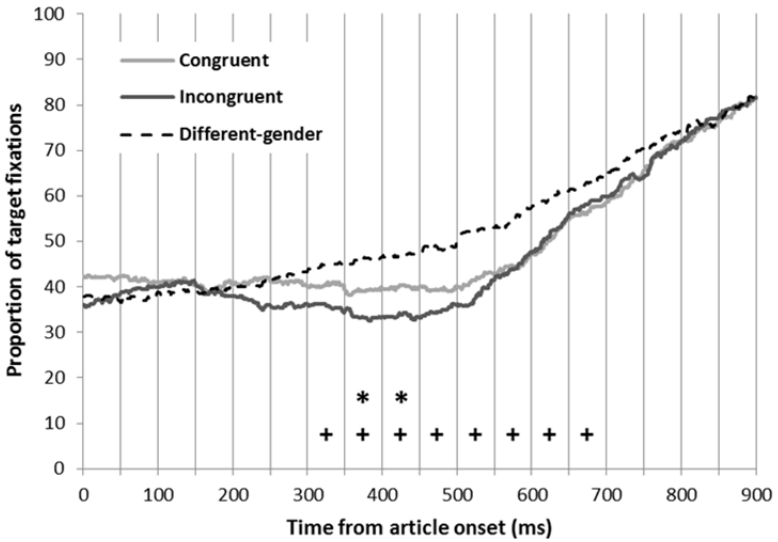

Figure 14 | *Total proportion of fixations to target pictures from article onset for Italian-Spanish bilinguals in Experiment 4. The symbol (*) represents the temporal window in which grammatical gender effect (congruent vs. incongruent) is significant; and (+) represents when the different-gender condition significantly differs from congruent or incongruent condition.*

To explore the processing of the gender information encoded by the definite articles, we compared the Different-gender condition vs. both the Congruent and Incongruent condition. In this case, when the two pictures differ in gender in both Italian and Spanish languages, we should observe an increased proportion of target fixations (Dahan et al., 2000; Dussias et al., 2013) relative to when both pictures vary in gender only in Italian. We performed successive t-test analyses through the different temporal windows comparing Different-gender vs. Congruent

condition, and Different-gender vs. Incongruent condition. Results indicated that different-gender trials started to diverge to the incongruent trials at the time window of 300 ms from the article speech signal [t (25) = 2.184, p = .03], and that this difference remained significant until the 650 ms time period (all ps < .05). In addition, comparisons showed that the different-gender condition began to differentiate from the congruent condition at the 450 ms temporal window [t (25) = 2.863, p = .008] and remained significant until 700 ms from the article onset (all ps < .05).

Comparison of the time courses of two gender effects (same-different gender trials and congruent-incongruent gender translations) seems to suggest that L2 determiner gender processing initiates 50 ms before L1/L2 gender co-activation (300 ms vs. 350 ms). However, the fact that Different-gender pairs started to diverge from the Incongruent condition 150 ms before the Congruent condition (i.e. 300 and 450 ms, respectively) can be interpreted in two possible ways. Specifically, it might be that incongruent gender targets were undermining the cue validity of the spoken (gendered) article in Spanish. By contrast, it might be the case that gender congruency strengthens the validity of the gendered L2 article as a cue during lexical selection. Despite the fact that it is difficult to dissociate between these two interpretations given the present data, we can nevertheless conclude that grammatical gender of L1 modulates spoken-word recognition shortly after L2 gender information becomes available to the bilinguals. These congruency effects were no longer present after 450 ms, suggesting that the cue ambiguity introduced by language co-activation at the gender level is relatively short-lived and is resolved as processing proceeds.

In conclusion, when the two pictures differed in gender the proportion of target fixations increased relative to the condition where both pictures shared gender in Spanish but were congruent or incongruent in Italian. Hence, as in previous studies (Dahan et al., 2000; Dussias et al., 2013), our results seem to indicate that bilingual speakers use the gender information encoded in the gender-marked definite articles to anticipate the selection of upcoming words during speech recognition. Additionally, when the two nouns of the pictures share gender in Spanish but they are incongruent in Italian, the proportion of target fixations are fewer and hinder the selection of the target.

Although our results clearly suggest that bilingual speakers are influenced by their native grammatical gender during spoken word recognition, we decided to conduct an additional experiment with Spanish monolingual speakers to be sure that: (1) No differences between congruent and incongruent condition are observed given that both pictures in these conditions always share grammatical gender in Spanish; and that (2) we observe a higher proportion of target fixations in different-gender trials because of the difference in gender between the two pictures helped participants to identify the picture correctly (Dussias et al., 2013).

EXPERIMENT 5

The aim of Experiment 5 was to further rule out the possibility that our experimental material was responsible for the overall pattern of results we observed. Thus, in Experiment 5 Spanish monolingual speakers performed the same spoken-word recognition task used in Experiment 4.

Method

Participants. Twenty-six Spanish monolingual speakers with a mean age of 22 years (*SD* = 3.99) voluntarily participated in the experiment. None of them reported having knowledge of Italian or being proficient at any other language.

Materials, design and procedure. The same experimental material and general procedure as those in Experiment 4 were used in this study.

Results and discussion

Errors in selecting the correct target were removed from the data analysis (overall, 0.34% of the total of trials). We defined a temporal window extending from 200 to 600 ms. This time corresponds to the moment in which eye movements are triggered by the information encoded in the definite article, and to the moment in which the differences between conditions disappeared (see Figure 15). An ANOVA performed on the proportion of target fixations revealed no interaction effects between Condition (congruent, incongruent, and different-gender) and Temporal window (8 different frames of 50 ms) [F (14, 350) = 1.146, MSE = 56.385, p = .31], and a main significant effect of Temporal window [F (7, 175) = 30.168, MSE = 75.323, p = .0001]. But, more importantly, data analysis also showed a significant effect of the variable Condition [F (2, 50) = 4.023, MSE = 839.428, p = .024]. Then, pairwise comparisons revealed that participants looked more at the target pictures in the different-gender trials (56.01%, SD = 14.32) than both in the congruent (49.55%, SD = 13.29, p = .045) and in the incongruent (48.61%, SD = 11.81, p = .007) gender trials. Also, pairwise

comparisons showed no differences between congruent and incongruent condition in monolingual speakers (p = .75).

This finding is expected because the items included in these conditions always shared gender in Spanish. Therefore, the difference in gender in Italian should not influence the latencies for the Spanish group of participants. This result indicates that the materials themselves were well controlled for in terms of their lexical properties and were not, per se, responsible for the difference found between the conditions in bilingual speakers.

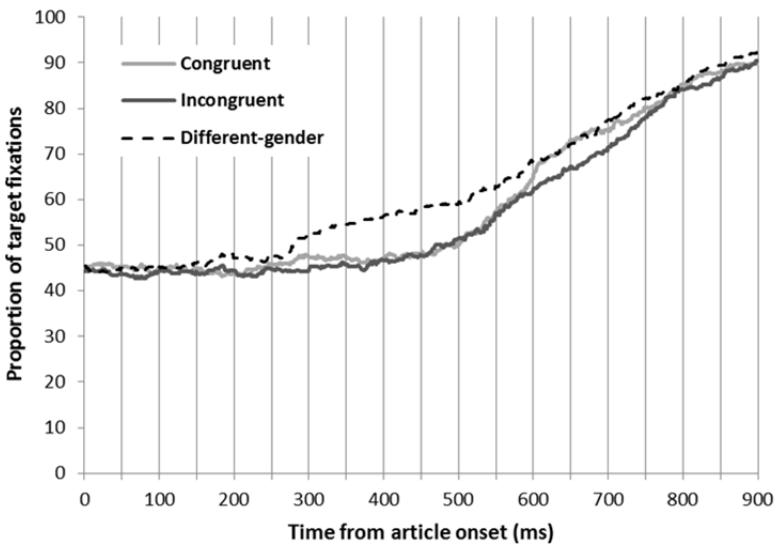

Figure 15 | *Total proportion of fixations to target pictures from article onset for Spanish monolingual speakers in Experiment 5.*

In addition, the results show that monolingual speakers also benefitted from the gender information provided by the definite articles during sentence processing. Specifically, when the two pictures differ in gender, hearing the definite article offers enough information to anticipate the selection of the target

picture, and 200 ms after the article speech signal the proportion of target fixations started to increase. In contrast, when the two pictures share gender (i.e. during the congruent and incongruent condition for Spanish speakers) participants delayed target selection until the onset of the disambiguating picture. Thus, approximately 200 ms after the noun onset signal the proportion of fixations to the target pictures begins to increase.

GENERAL DISCUSSION

The experiments reported in this study yield important results concerning L2 gender processing. Although grammatical gender congruency effects have been widely described through different pairs of languages during both production and recognition tasks (e.g., Bordag & Pechmann, 2007, 2008; Lemhöfer et al., 2008; Paolieri et al., 2010; Salamoura & Williams, 2007), little is known about how gender processing in L2 is influenced by the native language during on-line spoken comprehension tasks. In our study, when bilingual participants were asked in their L2 to find a picture in a display, they produced fewer fixations when the target picture was incongruent in gender between Italian and Spanish than when the target picture was gender-congruent. Thus, despite the fact that the task was performed in Spanish-L2, the activation of L1 influenced the pattern of eye fixations.

More importantly, results from Experiments 3 and 4 show that this influence was at the gender level of representation. Although, some phonological variables could have influenced the gender congruency effects in Experiment 3 by delaying the interpretation of the speech signal because of the orthographic and phonological overlap of some translations of the pictures'

nouns (Allopenna et al., 1998), when these variables were carefully controlled in Experiment 4, we continued to observe the influence of the native gender knowledge on L2 processing. In addition, because in Experiment 4 the pictures were not presented along with their articles+nouns before the eye tracking session, the participant's processing could not be biased by a gender-centered mode when performing the task. In support of the interpretation that between-language gender congruency effects were due to the interaction of the bilinguals' two languages at the gender level, monolingual speakers in Experiment 5 did not show any differences in the pattern of fixations between the congruent and incongruent conditions. This pattern of results is important, because it rules out explanations of the data based on other properties of the nouns themselves and speaks to the importance of grammatical gender on bilingual lexical access.

Importantly, this study supports the notion that the two gender systems interact not only during production or visual recognition tasks, but also during real-time interpretation of speech. Our results can be explained by assuming that L1 lexical representations were automatically activated by the pictures and that they spread their activation to the corresponding L2 lexical entries. Moreover, sharing (or not sharing) grammatical gender features affected the activation of upcoming words during the interpretation of spoken instructions by modulating the validity of the spoken (gendered) article in L2 as a cue for selection of the appropriate target. Indeed, other experiments have also shown that grammatical gender information influences lexical access in monolingual speakers (Dahan et al., 2000; Lew-Williams & Fernald, 2007). In this study, we show how bilinguals are also

influenced by the gender information of their native language during a comprehension task. Note that this and other studies (Paolieri et al., 2010; Salamoura & Williams, 2007) have shown gender interactions in gender-marked languages. However, the study by Dussias et al. (2013) indicates that the influence of gender also emerges in languages without clear grammatical gender rules (but see Lew-Williams & Fernald, 2010, for a failure to find gender effects in Spanish learners with English as L1).

Another important finding refers to the anticipatory effect for the different-gender trials, where the nouns associated to the two pictures did not share gender in neither of the two languages. In these trials, for both monolingual and bilingual speakers, hearing the definite article provided a valid cue to launch anticipatory fixations over the target pictures, which is perfectly predictable based on previous visual-world studies (Dahan et al., 2000; Dussias et al., 2013; Lew-Williams & Fernald, 2007). Therefore, we found an expected facilitatory effect during the processing of grammatical gender markers, showing how this property influences lexical access by providing valuable information to build sentence meaning during sentence interpretation in monolingual and bilingual language processing (Bates, Devescovi, Hernández, & Pizzamiglio, 1996; Grosjean, Dommergues, Cornu, Guillelmon, & Besson; 1994). This result is congenial with the idea that interlocutors incrementally process (i) linguistic information as it becomes available in the speech and (ii) information extracted from lexical items of pictures, in order to restrict the range of potential referents and facilitate the interpretation of the discourse (Chambers, Tanenhaus, Eberhard, Filip, & Carlson, 2002). Furthermore, it suggests that bilinguals

also benefit from gender cues during lexical selection when they are comprehending language in their L2 (Dussias et al., 2013).

Finally, the comparison of the two gender effects (same-different-gender trials and congruent-incongruent gender translations) provided new insights regarding the temporal dynamics of grammatical gender processing during bilingual spoken recognition. Thus, L2 gender processing as indexed by the same-different gender trial effect was evident 50 ms before L1/L2 gender coactivation (as signaled by gender congruency effects in the same-gender trials). This result suggests that gender co-activation arises early during the sentence processing but only after 50 ms L2 gender processing becomes evident. This seems to indicate that participants make a rapid use of the gendered determiners in the auditory stream, and that this process is shortly followed by the parallel activation of the languages. In a similar vein, some studies on language co-activation at the lexical level have shown that language lexical co-activation during visual sentence processing is not initiated at the very start of the reading process and it does not occur until some processing has taken place. For example, Macizo and Bajo (2006, Experiment 2b) reported a study in which Spanish-English bilinguals translated to L2 a series of sentences including cognates words. The authors found that translation was facilitated when cognates appeared only in the final fragment of the sentence (i.e. when the cognate was being read), suggesting that co-activation of languages may take some time to be built in bilingual sentence processing.

To conclude, this is the first study that –to our knowledge– bridges evidence on gender processing and on parallel activation of languages in bilinguals during a task requiring real-time processing of speech. Gender congruency effects in

comprehension domains had been previously reported using written-word recognition tasks (e.g. Lemhöfer et al., 2008). However, this study provides new evidence of gender effects in auditory comprehension, evidencing that, similarly to visual word recognition, gender can be also accessed independently of any morphological gender marker (Gollan & Frost, 2001). Our results speak in favor of the nature of incremental language processing, where listeners take advantage of all types of cues in real time to maximize efficiency in interpreting speech. This study provides evidence of how the first language remains activated when bilinguals perform a task in their second language. Moreover, not only co-activation, but even connections between languages, and competition during selection of the appropriate lexical items have been found in Italian-Spanish speakers. Finally, an important finding is that connections at the level of grammatical gender not only interfere (when gender is incongruent) but also facilitate access to L2 lexical information in the presence of gender congruency.

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CHAPTER V

Experiment 6

Transfer of Spanish grammatical gender to English: Evidence from immersed and non-immersed bilinguals*

In this study, we explored the possibility that the grammatical gender of native Spanish affects speech production in a second language lacking this feature (English) depending on the language immersion context. Participants named pictures in English-L2 while ignoring gender congruent or incongruent distractors according to the Spanish translation. Results revealed that only the non-immersed participants showed gender congruency effects, suggesting that bilinguals are influenced by their native gender and that immersion attenuates access to the native language. Our results show transfer effects between languages with different lexical systems, which seems to depend on language immersion.

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Grammatical gender is an inherent lexical feature of nouns existing in many languages (Corbett, 1991), that is stored at a level different from conceptual and phonological representations (Levelt, Roelofs, & Meyer, 1999). Recent evidence suggests that this property is automatically activated in the process of lexical access (Alario, Ayora, Costa, & Melinger, 2008; Cubelli, Lotto, Paolieri, Girelli, & Job, 2005; Paolieri, Lotto et al., 2010; but see Schiller & Caramazza, 2003). For instance, Paolieri and colleagues (2010) asked Italian and Spanish monolingual speakers to produce the bare noun of a picture (e.g. in Spanish, *perro*$_{(MAS)}$, "dog") while ignoring a distractor word that could be of the same grammatical gender (e.g. *cuchillo*$_{(MAS)}$, "knife"), or of different grammatical gender (e.g. *alfombra*$_{(FEM)}$, "carpet"). Results showed that both Italian and Spanish monolinguals were slower in naming the pictures in the congruent condition, suggesting that grammatical gender is accessed and selected in the process of lexical access even when the noun has to be produced outside a sentential context. Thus, when target and distractor pairs share the same grammatical gender, either the competition between candidates (Levelt et al., 1999) or the active inhibition of the distractor noun (Mahon, Costa, Peterson, Vargas, & Caramazza, 2007) slows down naming latencies.

Grammatical gender also has important effects on bilingual lexical access, as most evidence points to the non-target language being activated in parallel with the target language during reading, speaking and listening (Dijkstra, 2005; Hoshino & Thierry, 2011; Kroll, Sumutka, & Schwartz, 2005; Marian & Spivey, 2003). Specifically, a number of studies have shown that bilinguals are slower naming pictures or translating words when they are gender-incongruent between languages than when they

are congruent (Bordag & Pechmann, 2007, 2008; Lemhöfer, Spalek, & Schriefers, 2008; Morales, Paolieri, & Bajo, 2011; Paolieri, Cubelli et al., 2010; Salamoura & Williams, 2007). This suggests that bilingual speakers are not exempt from the gender influence of their native language when performing a task in their L2 and that this effect is not limited to gender-marked utterances. Bilingual gender effects can be explained by assuming that lexical entries in L1 are automatically activated by pictures which in turn spread their activation to the corresponding L2 lexical representations. The compatibility in gender between the two entries would cause facilitation in selecting the appropriate noun and, consequently, response latencies would speed up relative to the conditions where the two translation equivalents do not share the same gender.

Contrary to what happens in languages with a grammatical gender system, English is a language which lacks noun classes based on this feature. In our study we explored whether bilingual speakers transfer grammatical gender properties from a language based on a gendered system –Spanish– to another lacking this property –English–. Although there is evidence suggesting that gender features in L1 can be transferred to languages without this type of representation during recognition and comprehension tasks, there is no data regarding gender interactions during language production. To illustrate, a recent study by Boutonnet, Athanasopoulos, and Thierry (2012) has shown that the grammatical gender of Spanish-L1 speakers affected the semantic categorization of a series of objects during a task performed in English-L2: ERPs results revealed a LAN modulation when the objects to be categorized were gender incongruent. Their results indicate that grammatical gender of nouns in the native language

influences comprehension even in a second language that lacks such grammatical properties (Ganushchak, Verdonschot, & Schiller, 2011; Midgley, Wicha, Holcomb, & Grainger, 2007; Sabourin, Stowe, & de Haan, 2006).

Altogether, all this evidence demonstrates that second language comprehension depends partly on the structure of the L1, since some properties of the native language affect language processing in L2. Our aim was to explore whether L1 grammatical gender also affects L2 processing during production. In addition, we wanted to investigate if these cross-language gender influences are modulated by language immersion. In this way, Linck, Kroll, and Sunderman (2009) provided evidence showing that immersion improves L2 learning by attenuating the negative influence of L1. In their study, English-speaking learners of Spanish, who were immersed in an L2 context, were exposed to a production and comprehension task. The results revealed that this immersed group outperformed classroom learners of Spanish non-immersed in a Spanish context. But, more importantly, their results also showed that immersed learners inhibited their L1 while living in the L2 context, supporting the notion that bilinguals must launch inhibitory processes to suppress one of the languages when using the other (Abutalebi & Green, 2008; Levy, McVeigh, Marful, & Anderson, 2007; Macizo, Bajo, & Martín, 2010; Meuter & Allport, 1999). Therefore, it is possible that bilingual speakers immersed for a long period in a second language context are relatively less affected by their native grammatical gender than non-immersed bilinguals.

In short, we hypothesized that similar to phonological features (Hoshino & Thierry, 2011), grammatical gender might also show transfer effects during bilingual production. Thus, we predict that

Spanish-English bilinguals would be affected by the gender properties of L1 when using L2 (English), even though this property is absent in English. Participants were asked to name pictures in English while ignoring Spanish distractor words printed on them. Although in this experimental context participants are not in a purely monolingual mode (Costa, Heij, & Navarrete, 2006), it is relevant to explore whether the gender representations of the non-response language are activated in the course of producing the target language, as it has been established for semantic and phonological features (e.g. Costa & Caramazza, 1999; Hermans, Bongaerts, De Bot, & Schreuder, 1998). Therefore, if English lexical entries automatically activate their corresponding L1 entries with their grammatical representations, we should observe slower naming latencies when target noun and distractor word are similar in gender across translations relative to the dissimilar condition. Additionally, participants were immersed in either a purely L1 (Granada, Spain) or L2 (State College, Pennsylvania, USA) language context. Given that previous research has shown that immersion experience constrains lexical access to L1 because it is inhibited during immersion (Linck et al., 2009), we predicted that gender effect would only be observed in the group of non-immersed bilinguals.

EXPERIMENT 6

Method

Participants. Three groups of 24 participants voluntarily took part in this study. The first group was composed of Spanish-English bilinguals that carried out the experiment at the University of Granada where Spanish is the dominant language

and therefore they were immersed in a purely L1 context (non-immersed bilinguals). The second group was also composed of Spanish-English bilinguals but they were immersed in an L2 context (immersed bilinguals) since the experiment was carried out at Penn State University. We only selected participants who were immersed in the L2 country for a period of at least two years. Finally, the third group was composed of monolingual English speakers from Penn State University; none of them reported having knowledge of Spanish or being proficient at any other language. The English proficiency of the bilingual participants was assessed through the Language Experience and Proficiency Questionnaire (Marian, Blumenfeld, & Kaushanskaya, 2007). Previous studies have shown reliable relationships between self-reported and behavioral measures (see, for instance, Colzato et al., 2008; Costa, Kovacic, Franck, & Caramazza, 2003, for studies that also use self-reported measures of language proficiency) with this questionnaire becoming an efficient tool for assessing bilingual language status in research settings.

As can be seen in Table 4, the two groups of bilinguals did not differ (all *t*s < 1) in any measure related to proficiency or language use except language immersion.

Table 4 | *Language history and self-evaluated proficiency scores of the Spanish-English bilinguals for both non-immersed and immersed group (mean are shown with corresponding standard deviations in parentheses)*

	Non-immersed	Immersed
Age (years)*	23.21 (3.50)	26.75 (8.25)
Language history**		
Acquisition L2 (age)	7.83 (2.91)	9.63 (6.47)
Fluent in L2 (age)	16.92 (3.19)	18.75 (8.36)
Reading L2 (age)	11.92 (3.74)	11.13 (6.54)
Fluent-reading L2 (age)	15.79 (3.61)	17.75 (7.72)
Length of immersion (months)	11.29 (10.17)	66.42 (46.49)
Self-evaluated proficiency level questionnaire in L2***		
Production	7.50 (0.78)	8.04 (1.30)
Comprehension	8.33 (1.09)	8.25 (1.22)
Reading	8.67 (0.87)	8.71 (1.04)

** The mean age of monolinguals was 23 years (SD = 5.23).*

***Description of the fields: Acquisition L2 (age when began acquiring L2); Fluent in L2 (age when became fluent in L2); Reading L2 (age when began reading L2); Fluent-reading L2 (age when became fluent reading L2); Length of immersion (number of months living in a country where L2 is the official spoken language).*

****Note: The scores are on a 10-point scale, in which 10 represents native-speakers level and 1 complete lack of knowledge of the language.*

Design and materials. Participants performed a picture-word naming task in which they were asked to name the pictures in English-L2 while ignoring a superimposed distractor word written in Spanish-L1. Twenty-eight pictures were selected from the pictures database of Snodgrass and Vanderwart (1980) and Lotto, Dell'Acqua and Job (2001), half with masculine names and

half with feminine names in Spanish (see Appendix E). Each picture was paired to a distractor noun of the same grammatical gender (Congruent condition; e.g. *CEPILLO*$_{(MAS)}$, "brush"; *gusano*$_{(MAS)}$, "worm") and a distractor noun of different grammatical gender (Incongruent condition; e.g. *CEPILLO*$_{(MAS)}$; *naranja*$_{(FEM)}$, "orange"). Both conditions were created by reassigning the distractors from the Congruent condition to different targets in the Incongruent condition, resulting in 28 picture-word pairs per condition that were semantically and phonologically unrelated. The nouns of the pictures and distractors had transparent suffix for gender (i.e. with the vowel endings *–a* for the feminine and *–o* for the masculine). The names of the target and distractor pairs were matched in Spanish and English (all *t*s < 1) for length, frequency (Alameda & Cuetos, 1995; Brysbaert & New, 2009), and phonological/orthographic overlap (cognate words were excluded).

Four experimental lists were created and counterbalanced across participants. The order of the pairs within the lists were pseudo randomized so that: (1) No more than three congruent or incongruent pairs appeared consecutively; (2) the lag between repetitions of a particular picture or distractor word was of at least three trials; and (3) there was no semantic or phonological relationship between pictures or distractor words in consecutive trials. Two additional filler pairs were included as warm-up trials at the beginning of each list.

Procedure. Participants were tested individually and were asked to name the pictures in English-L2 as quickly and accurately as possible while ignoring the L1 distractor word. Pictures were centered at fixation (included in a virtual square of about 6x6

cm) with the distractor words simultaneously presented at the center of the pictures. A trial consisted of the following events: A fixation point presented at the center of the screen for 500ms; the presentation of the picture-word pair until the participants' response or for a maximum of 4000ms; and a blank interval for 1000ms before the next trial. Response latencies were measured from the onset of the stimulus until the beginning of the response. Previous to the experimental session, a practice block of sixteen trials was administered.

Finally, the LEAP-Q (Marian et al., 2007) for evaluating L2 proficiency was administered to bilingual participants.

Results

Naming latencies exceeding two standard deviations from the participant's mean, naming errors, no responses, and verbal dysfluencies were excluded (overall, 16% of the trials for the non-immersed group, 14% for the immersed group; and 11% for the monolingual speakers). Additionally, the item *tapadera*$_{(FEM)}$ ("lid") was removed from the global analysis because of its high percentage of null and wrong responses (85% of the trials). To maintain the same number of items across genders (i.e. masculine and feminine) in the final analysis, the masculine item with the higher rate of errors was also removed (*zorro*$_{(MAS)}$, "fox", 25% of the trials).

Separate analyses were carried out for participants and items yielding F1 and F2 statistics. We performed ANOVAs with the variable Group (immersed bilinguals, non-immersed bilinguals, and monolingual speakers) as between-subjects factor, and

Condition (congruent and incongruent) as within-subject factor[9]. The mean response times are reported in Table 5. The main effect of condition [F_1 (1, 69) = 9.894, *MSE* = 1191.98, p = .002, η_p^2 = .125; F_2 (1, 75) = 2.047, *MSE* = 7269.57, p = .15] and the interaction of condition and group were significant by participants [F_1 (2, 69) = 4.184, *MSE* = 1191.98, p = .019, η_p^2 = .108; F_2 (2, 75) = 1.547, *MSE* = 7269.57, p = .22]. The effect of Group was significant by participants and items [F_1 (2, 69) = 28.134, *MSE* = 27239.06, p = .0001, η_p^2 = .449; F_2 (2, 75) = 64.244, *MSE* = 12796.18, p = .0001, η_p^2 = .631]. As expected, the group of non-immersed bilinguals showed significant gender effects [F_1 (1, 23) = 12.145, *MSE* = 1618.52, p = .002, η_p^2 = .346; F_2 (1, 25) = 4.179, *MSE* = 8797.88, p = .05, η_p^2 = .143], while no gender effects were observed either for the group of immersed bilinguals [F_1 (1, 23) = 1.458, *MSE* = 1443.88, p = .239; F_2 (1, 25) = .055, *MSE* = 10582.09, p = .817] or for the English monolingual speakers [F_1 (1, 23) = .008, *MSE* = 513.55, p = .930; F_2 (1, 25) = .009, *MSE* = 2428.74, p = .927].

Finally, because of the low naming error rates (less than 4% of the total of trials per condition and group) an analysis based on naming errors was not plausible.

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[9] We performed an ANOVA including gender (masculine vs. feminine) in the analyses. Although, the main effect of Gender was significant [F1 (1, 69) = 9.675, MSE = 5502.56, p = .003, ηp2 = .123; F2 (1, 72) = 4.338, MSE = 12554.76, p = .041, ηp2 = .057], with slower naming latencies for feminine nouns (919ms, SD = 74) relative to masculine nouns (883ms, SD = 57), this factor did not interact with any other variable, indicating that the effects of condition and group were similar for both gender conditions.

Table 5 | *Mean response latencies (in milliseconds) and standard deviations in the different experimental conditions through the groups: Non-immersed Spanish-English bilinguals; Immersed Spanish-English bilinguals; and English monolingual speakers.*

	Non-immersed		Immersed		Monolinguals	
Condition	Mean	SD	Mean	SD	Mean	SD
Congruent	955	146	1001	136	752	72
Incongruent	915	129	988	129	752	78
Effect	*40*		*13*		*0*	

DISCUSSION

In this study we aimed to investigate how grammatical gender of the native language influences language production in bilinguals when speaking in a language lacking this property. Spanish-English bilinguals named pictures in English-L2 while ignoring L1 distractor words that had the same or different gender of the target L1 translation. In addition, we varied language immersion by including a group of bilingual speakers immersed in an L1 context at the moment of the experiment (Spain), and another group immersed in a country where L2 was the dominant language of use (USA). The results evidenced that the group of non-immersed speakers was influenced by their native gender information even when they were asked to name the pictures in English, a language in which grammatical gender is not present for nouns. This pattern of results was not observed in the group of immersed bilinguals, suggesting that access to L1 is attenuated during language immersion. Similarly, congruency effects were not present in the monolinguals, indicating that the materials themselves were not a possible factor accounting for the results in the bilingual groups.

Although transfer of grammatical gender properties have been reported during recognition and comprehension in bilinguals (Boutonnet et al., 2012; Ganushchak et al., 2011; Midgley et al., 2007; Sabourin et al., 2006), there were no previous studies showing transfer of grammatical gender to non-gendered languages during production. The transfer of Spanish-gender effects to English can be explained by assuming that the lexical entry corresponding to the target noun in L1 is active along with its corresponding translation during the production of the noun in L2, thus interfering with the distractor word. Because grammatical gender is not present in English, only the gender information of L1 could be responsible for the difference found in naming latencies between the two conditions. Therefore, when target and distractor share gender, the interference delays the selection of the target noun and latencies are prolonged.

Evidence regarding cross-language transfer effects is not new in the study of bilingualism. Hoshino and Thierry (2011) found that Spanish-English speakers are slower naming pictures in L2 while ignoring distractor words phonologically related to the Spanish or English name of the pictures, demonstrating that the transfer of phonology native information is present during word production in L2. We propose that a similar transfer of grammatical gender properties from the first to the second language occurred in our study.

The presence of cross-language influences at this level also provides evidence regarding the proposal that grammatical gender is a property of nouns that is automatically accessed and subject to competitive processes during lexical access and production of bare nouns (Cubelli et al., 2005; Paolieri, Lotto et al., 2010). However, this effect is difficult to explain by some

theories of speech production (Caramazza, 1997; Levelt et al., 1999) proposing that gender is selected only in the production of gender-marked utterances. This last proposal is based on the fact that gender effects are not observed in bare noun production in Germanic languages (La Heij, Mak, Sander, & Willeboordse, 1998; Starreveld & La Heij, 2004). However, our results and others (Cubelli et al., 2005; Paolieri, Lotto et al., 2010) clearly show gender effects in bare-noun tasks in Spanish and Italian languages, suggesting that gender congruency effects may depend on the specific, formal, morphosyntactic properties of individual languages (Cubelli & Paolieri, 2008).

In addition, the current experiment adds to the evidence showing that language immersion modulates lexical access of the native language (Linck et al., 2009; but see Hoshino & Thierry, 2011). For example, Linck and collaborators (2009) compared the performance of two groups of Spanish learners that differ in their immersion experience (immersed in a Spanish-speaking environment versus classroom learning) in a translation recognition task including incorrect translations (distractors) that were similar in meaning or phonology to the corresponding Spanish words. Immersed learners were less likely than the non-immersed students to make errors in the similar distractor English words. In addition, they produced less L1 and more L2 exemplars than the non-immersed students in a verbal fluency task. They interpreted these findings as suggesting immersed learners have benefits in L2 learning as a result of the reduced influence of their native language that was inhibited during immersion. The results of our experiment also speak in favor of this idea because the group of L2 immersed bilinguals was not influenced by their L1 gender knowledge while performing the

picture-naming task: they outperformed the non-immersed group because their access to L1 was reduced due to the L2 immersion experience. Although several other theoretical explanations besides inhibition are also congruent with our immersion results (reduced frequency of use of the native language when immersed or more difficult to switch into an L1 set, Meuter & Allport, 1999), we can, however, conclude that the access to the native language is prevented during immersion in a second language context.

To summarize, this study demonstrates that L2 language production is influenced by the syntactic features that are peculiar to the native language of the participants even though they are irrelevant for L2 processing and that this cross-language transfer effect is modulated by language immersion.

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CHAPTER VI

Experiment 7

Grammatical gender inhibition in bilinguals*

Inhibitory control processes have been recently considered to be involved in interference resolution in bilinguals at the phonological level. In this study we explored if interference resolution is also carried out by this inhibitory mechanism at the grammatical level. Thirty-two bilinguals (Italian-L1 and Spanish-L2) participated. All of them completed two tasks. In the first one they had to name pictures in L2. We manipulated gender congruency between the two languages and the number of presentations of the pictures (1 and 5). Results showed a gender congruency effect with slower naming latencies in the incongruent condition. In the second task, participants were presented with the pictures practiced during the first naming task, but now they were asked to produce the L1 article. Results showed a grammatical gender congruency effect in L1 that increased for those words practiced five times in L2. Our conclusion is that an inhibitory mechanism was involved in the suppression of the native language during a picture naming task. Furthermore, this inhibitory process was also involved in suppressing grammatical gender when it was a source of competition between the languages.

* The study included in this chapter corresponds to the content of the paper published as Morales, L., Paolieri, D., & Bajo, T. (2011). Grammatical gender inhibition in bilinguals. *Frontiers in Psychology, 2*:284.

One important question in bilingual language processing is how people who speak two or more languages are able to control their linguistic production. People immersed in a context of second language acquisition often make mistakes and access native language words even when the alternative language is needed (Kroll & Stewart, 1994; Colomè, 2001). Furthermore, sometimes they report forgetting some words in their native language, when it is infrequently practiced (Seliger & Vago, 1991; De Bot, 1999). One approach to understanding these detrimental effects has been to propose that they are produced by a process that is similar to that producing forgetting during memory retrieval. Levy et al. (Levy, McVeigh, Marful, & Anderson, 2007) have shown that retrieving some information from memory can produce forgetting of associated competing information (Anderson, Bjork, & Bjork, 1994). They have suggested that forgetting of first-language lexical representation when immersed in a second language context may be due to an attentional inhibitory mechanism that suppresses unwanted memories to facilitate retrieval of the relevant information (Levy et al., 2007). In general, any situation that requires memory retrieval in the presence of competition will entail inhibition of the competing information (Anderson et al., 1994, 2000; Anderson & Spellman, 1995; Anderson & McCulloch, 1999; Anderson & Green, 2001). An indirect consequence of this process is that the inhibited information will be less accessible and harder to retrieve at a later moment. Two important properties of inhibition as a memory selection mechanism is that (1) inhibition depends on the presence of competition (Anderson et al., 1994); and (2) it is specific to the dimension of the memory representation that is competing for selection, meaning that inhibitory effects should depend on the degree to which the memory trace tapped by the

final test matches the memory trace that was competing during the encoding phase. For example, if competition is lexical in nature (i.e., words starting with the same beginning), inhibition will specifically act upon the lexical representation that will be less accessible in a later test. But, to capture lexical inhibition, a lexical test (i.e., lexical decision) would be needed (Tulving & Thomson, 1973; Morris, Bransford, & Franks, 1977; Bajo, Gómez-Ariza, Fernández, & Marful, 2006).

Hence, similar to what occurs in memory, first-language forgetting may arise, at least in part, from the suppression or inhibition of native language. For that to occur, interference and competition between the two languages of the bilingual are required (Kroll & Stewart, 1994). The aim of the experiments reported in this paper is to show that in similar vein grammatical gender can also be inhibited. In order to provide a context for this claim, we will first discuss the evidence regarding language co-activation and between-language competition at the lexical and grammatical level and next we will go back to the evidence regarding inhibitory control in language selection.

LANGUAGE CO-ACTIVATION AND COMPETITION

Numerous studies have provided evidence that linguistic properties of the non-intended language affect the production of the intended language at the semantic and the phonological levels (Hermans, Bongaerts, de Bot, & Schreuder, 1998; Costa & Caramazza, 1999; Costa, Miozzo, & Caramazza, 1999; Costa, Caramazza, & Sebastián-Gallés, 2000; Colomè, 2001; Dijkstra, 2005; Macizo & Bajo, 2006; but see Costa, La Heij, & Navarrete, 2006, for a critical discussion). For instance, in a series of

picture–word tasks, Costa et al. (1999) reported lexical connections between the two systems of bilingual Catalan–Spanish speakers. They found interference effects when participants had to name pictures presented with semantically related words for both same- and different-language conditions, relative to when they were presented with semantically unrelated words. On the other hand, Colomè (2001) used a phoneme monitoring task on words self-elicited from pictures to demonstrate that the language that a bilingual is not using is nevertheless activated. When Spanish–Catalan bilinguals had to decide if a specific phoneme was present in the Catalan name of the picture, participants took longer to reject the phoneme when it was part of the Spanish word relative to a control condition.

Given the evidence of interaction between the semantic and phonological features of the lexical systems in bilinguals, we can also expect between-language competition at the level of grammatical gender. Grammatical gender has been proposed to be a property of the nouns that is stored at one representational level different from conceptual and phonological information (Caramazza & Miozzo, 1997; Levelt, Roelofs, & Meyer, 1999). However, how grammatical gender interacts during lexical selection in bilinguals is more controversial (Costa, Kovacic, Franck, & Caramazza, 2003; Salamoura & Williams, 2007; Bordag & Pechmann, 2008; Lemhöfer, Spalek, & Schriefers, 2008; Paolieri, Cubelli, et al., 2010), probably due to the different characteristics of the gender systems in different languages. For instance, Costa et al. (2003) assume a complete autonomy of the gender systems of the two languages of the bilinguals. In a series of picture naming experiments manipulating grammatical gender congruency in different pairs of languages, the authors found

similar naming times for same- and different-gender pictures. Costa et al. (2003) concluded that the grammatical gender of the words in the non-response language does not affect lexical processing in the response language. In contrast, Bordag and Pechmann (2007) and Lemhöfer et al. (2008) reported L1 and L2 interactions at the grammatical level of representation in Czech–German and German–Dutch bilinguals, respectively. Furthermore, they observed between-language gender interaction even when they controlled for the influence of phonological form (e.g., noun termination) in both production and comprehension tasks (Bordag & Pechmann, 2007); and even when using a lexical decision task where the cognate status of the words was manipulated (Lemhöfer et al., 2008).

Within the context of bilingualism, the effect of gender congruency has been also found in both bare noun production and noun phrase production with German–Dutch and Italian–Spanish speakers (Lemhöfer et al., 2008; Paolieri, Lotto, et al., 2010)[10]. Paolieri and colleagues (Paolieri, Cubelli, et al., 2010) observed robust gender congruency effects with Italian–Spanish bilinguals. In this study participants had to name pictures in L2

[10] The selection of grammatical gender in bare noun production is a controversial topic in monolingual language production. A reliable effect of grammatical gender congruency in bare noun production has been found in Italian and Spanish, two Romance languages with a similar morphological system. In contrast, with Italian and Spanish, the gender congruity effect has never been observed in Dutch (La Heij, Mak, Sander, & Willeboorsde, 1998; Starreveld & La Heij, 2004), where no inflection has to be selected for the production of bare nouns. To explain the different pattern of results in Italian, Spanish, and Dutch, Cubelli et al. (Cubelli, Lotto, Paolieri, Girelli, & Job, 2005; see also Paolieri, Lotto, Leoncini, Cubelli, & Job, 2011) assumed that the gender congruency effect in the picture–word paradigm depends on the specific, formal, morphosyntactic properties of individual languages.

or to translate words from L1 to L2, producing either bare noun or noun phrases. In all conditions, participants showed shorter response latencies when the nouns of the two languages shared grammatical gender than when their grammatical gender was different. Thus, independently of the type of task (L2 picture naming or forward translation) and on the type of response (bare noun or noun phrase), their results speak in favor of grammatical gender interactions between the two languages of the bilinguals. These results contradict the notion that grammatical gender is only selected when producing gender-marked utterances (Caramazza & Miozzo, 1997; Levelt et al., 1999), and support the idea that the selection of one lexical node involves obligatory access to syntactic features (Cubelli et al., 2005; Paolieri, Cubelli, et al., 2010; Paolieri, Lotto, et al., 2010). And more importantly, they suggest that the two lexical–grammatical representations of the words are activated in the bilinguals mind and compete whenever lexical selection is needed.

INHIBITORY CONTROL IN LANGUAGE SELECTION

Given that most studies point to a non-selective activation of languages during bilingual production, the question concerns how the system handles such unintended activation. For example, the model proposed by Costa and collaborators (Costa et al., 1999; Costa, 2005) assumes that although the lexical candidates in both languages are active simultaneously, the intention to speak only one of them restricts selection to the target language. In this way, co-activation does not lead to interference and competition during the planning of the utterance.

However, another possibility is that both lexical representations also compete for selection, and that such selection is managed by inhibitory processes acting on the lexicon. One version of inhibitory model (Inhibitory Control Model; Green, 1998) claims that inhibitory control is triggered whenever active lexical representations from the two languages compete for selection. This inhibitory mechanism is in charge of suppressing the non-target representations; as a consequence between-language interference is reduced and selection of the appropriate entries is facilitated. The role of inhibitory processes on selection is not restricted to the bilingual field, but it is shared with other cognitive areas such as visual attention, memory and language comprehension and production. For example, popular explanations of the inhibition of return effect (e.g., Tipper, Grison, & Kessler, 2003) have suggested that already-sampled spatial locations are inhibited to facilitate visual search. Similarly, some memory theories assume that inhibition of competing representation facilitate retrieval of target memories (Anderson et al., 1994), and many theories of language production assume that lexical selection is achieved by means of inhibitory connections at the level of lexical representations (e.g., Berg & Schade, 1992; Cutting & Ferreira, 1999). Hence, research in different cognitive domains has suggested that both lexical and perceptual representations can be inhibited.

Most of the evidence regarding inhibitory language control comes from results of the language switching tasks (Meuter & Allport, 1999; but see Abutalebi & Green, 2008; for a review). In these studies participants are required to name digits or pictures in L1 or L2 in an unpredictable manner. Hence, there are trials in which the response language is the same as that in the preceding

trial (non-switch trials) and trials in which the response language differs from the preceding trial (switch trials). When bilinguals perform this task they are slower in switching trials relative to non-switch trials (switching cost), but the most interesting pattern is that switching from L2 to L1 produces a larger cost than switching from L1 to L2. This asymmetrical cost has been interpreted as evidence of inhibition by assuming that naming in L2 requires inhibition of the more dominant L1, so that when bilinguals switch back into the L1 naming, additional time would be required to overcome the strong inhibition of L1 representations.

Similarly, Linck et al. (Linck, Kroll, & Sunderman, 2009) provided support for the inhibitory account in a study in which they compared L2 learners immersed in a L2 context with L2 learners without immersion experience. In a very simple task, they showed that relative to classroom learners, the immersed learners produced significantly more examples in L2, but more interestingly, they produced significantly fewer examples in their L1, indicating that L2 immersion increases the amount of inhibition on L1 so that L1 become less available for the immersed bilinguals. Note that inhibition in the language switching and verbal fluency tasks are global in nature and directed to the non-appropriate language. In this sense, these tasks do not tap into specific memory representations since the lexical and conceptual units change from one trial to next and therefore is the language what it needs to be inhibited.

Evidence for representation specific inhibition comes from several recent lines of research. For example, Macizo et al. (Macizo, Bajo, & Martín, 2010) and Martín et al. (Martín, Macizo, & Bajo, 2010) asked Spanish–English bilinguals to

perform a relatedness judgment task including interlexical homographs (e.g., "pie," meaning "foot" in Spanish). Pairs of English words were presented and the participants had to decide whether or not they were related. Results indicated that participants were slower to respond to homographs presented along with words related to the irrelevant Spanish meaning of the homograph relative to control words (e.g., "pie-toe" vs. "log-toe"). Moreover, after responding to homographs, the participants responded more slowly when the following trial required activation of the irrelevant homograph meaning (e.g., "foot-hand" preceded by "pie-toe"). These results suggest that bilinguals activated both of their languages (homograph interference) and that they inhibited the irrelevant homograph meaning in order to overcome interference and perform the task.

Similarly, Levy et al. (2007) have also demonstrated that inhibition is responsible for the suppression of native language at the phonological level. In their study, native English speakers had to name pictures in Spanish-L2 for 1, 5, or 10 times (e.g., culebra; snake). Afterward, the accessibility to the same words in the native language was measured using an independent probe (Anderson & Spellman, 1995) rhyme test (e.g., break-s___). Results showed that words named in Spanish (L2) 5 or 10 times led to decreased recall of the corresponding English (L1) names than those named in L1 or named in L2 only once. Moreover, in Experiment 2 they were able to isolate the specific inhibitory effect to phonology since presenting semantic cues (e.g., venom-s___) did not produce the forgetting effect of naming repeatedly pictures in L2. Thus, repeatedly naming L2-words inhibited the phonology of their English (L1) names, but facilitated concept accessibility. The authors conclude that phonological first-

language attrition arises from inhibition of the phonological native language representations during second language use. This experiment illustrates the importance of inhibitory mechanism in overcoming interference during second language acquisition.

Hence, although there is much evidence showing that the two language systems of the bilingual interact at the semantic, phonological, and grammatical levels (Costa & Caramazza, 1999; Costa et al., 2000; Colomè, 2001; Paolieri, Cubelli, et al., 2010), and that inhibitory mechanisms are triggered to reduce the interference due to co-activation at the semantic (Macizo et al., 2010; Martín et al., 2010) and phonological level (Levy et al., 2007; but see Finkbeiner, Almeida, Janssen, & Caramazza, 2006, for a critical discussion), there is no evidence showing that inhibitory processes can also act at the lexical/grammatical (gender) level of representation.

The aim of this study is to confirm that the two lexical systems of the bilingual are activated and interact at the grammatical gender level, and more interestingly, to investigate whether inhibitory mechanisms are responsible for resolving between-language competition at this representational level. Similarly to Levy's study (Levy et al., 2007), we asked Italian native speakers to name pictures in Spanish-L2 by producing bare nouns. In this first picture naming phase, we manipulated the gender congruency of the nouns between the two languages (grammatical gender congruent vs. grammatical gender incongruent) and the number of presentations of each picture (one or five times), in order to create more or less L1 inhibition. Note that picture naming involves the activation of the grammatical properties of the language (Cubelli et al., 2005; Paolieri, Cubelli, et al., 2010; Paolieri, Lotto, et al., 2010), as long as these grammatical

properties of the two languages are activated and are incongruent (Paolieri, Cubelli, et al., 2010), they will compete for selection and the inappropriate grammatical feature would be inhibited. Hence, words with incongruent gender in the two languages would produce competition that in turn would trigger inhibition. In addition, the higher the number of naming trials in L2, the greater the inhibition that would act upon the particular L1 incongruent grammatical property.

In the second phase, participants had to complete an article production task in Italian-L1 for the same pictures practiced in L2 during the first task. This task was selected because it specifically captures gender access since participants are asked to produce only the definite article. We expected that trials containing incongruent gender stimulus would show slower response times when producing the article in L1; and more importantly, that this difference would be larger for words practiced more times in the previous L2 naming task. For this later task, new pictures (never presented during the naming phase of the experiment) were added as a baseline to observe the effect of previous naming (see Levy et al., 2007, for a similar procedure). Given that participants had to produce the definite article in their native language, we did not expect gender effects for these new items.

EXPERIMENT 7

Method

Participants. Thirty-two Italian–Spanish bilinguals voluntarily participated in the experiment. L2 proficiency was assessed at the end of the session through a subjective questionnaire (see Table 6

for a description of the sample of participants). They all had normal or corrected-to-normal vision.

Table 6 | *Language history and self-evaluated proficiency scores of the Italian-Spanish bilinguals*

Age (years)	24.66 (4.83)
Language history	
Use of L2 (years)	2.88 (4.41)
Living in Spain (years)	2.13 (3.03)
Self-evaluated proficiency level test in L2	
Production	7.22 (1.22)
Comprehension	8.00 (1.41)
Writing	6.22 (1.76)
Reading	7.75 (1.54)

Note: the scores are on a 10-point scale, in which 10 represents native-speakers level and 1 complete ignorance of the language. Mean are shown, with standard deviations in parentheses.

Design and materials. The experiment consisted of two main phases: (1) Picture naming task in L2 (Spanish) by producing bare nouns, and (2) Retrieval of L1 article corresponding to the presented pictures. This design was created in order to produce the inhibition of Italian-L1 gender by naming gender congruent and incongruent items in Spanish-L2 during the first part of the experiment, and then measure access to the specific representations of these lexical entries during the Italian-L1 task (see Levy et al., 2007, for a similar procedure).

Grammatical gender (Congruent vs. Incongruent) and Number of presentations of each picture (1 vs. 5) were manipulated within subjects during the Spanish (L2) naming task. Seventy-two

pictures were chosen from the sets of Lotto, Dell'Acqua, and Job (2001), half with the same gender in Italian and Spanish (e.g., *Sciarpa*$_{FEM}$ and *Bufanda*$_{FEM}$, in Italian and Spanish respectively –scarf–) and half with different gender (e.g., *Letto*$_{MAS}$ and *Cama*$_{FEM}$, in Italian and Spanish respectively –bed–). At the same time, half of the words were masculine and half were feminine in gender. This set of stimulus consisted of 48 experimental pictures to be used both in the first and second task, and 24 additional control items to be included as baseline for the second task (a complete list of the stimulus materials is provided in Appendix F). Cognate words were not included as experimental material. Gender Congruent and Incongruent words did not differ (all *t*s < 1) for frequency (Alameda & Cuetos, 1995 for Spanish, and Bertinetto et al., 2005 for Italian), number of letters, number of syllables, and phonological/orthographic overlap. The last one was calculated computing the percentage of number of letters shared by the words in the two languages.

For the picture naming task in L2 (task 1), half of the pictures were presented once and half five times. Two different pseudorandom lists including 48 experimental items were created. Lists were constrained as follows: (1) No more than three congruent or incongruent stimuli could appear consecutively; (2) the lag between repetitions of a particular picture had to be of at least three trials; (3) no semantic or phonological relationship could exist between pictures in consecutive trials. Finally, each list included a total of 144 trials. Repetitions of each picture and list were counterbalanced across participants.

Regarding the article retrieval task in L1 (task 2), one randomized list was created and divided in two blocks counterbalanced across

participants. The list consisted of a total of 72 trials (48 experimental pictures named in L2 during the previous task plus 24 new control pictures).

Procedure. Participants were tested individually. The experimenter was seated behind the participant to record errors and responses. The stimuli were presented using E-Prime experimental software, 1.1 version (Schneider, Eschman, & Zuccolotto, 2002). The whole experiment lasted about 40 min. Before starting, participants completed a familiarization phase with the complete set of pictures. A trial in the familiarization phase consisted of the presentation of each picture with its translation in both languages (e.g., "Il letto – La cama," for the picture of a bed). The participants had to indicate to the experimenter if they knew the words in Spanish (L2). Then, the experimental tasks were administered in the following order: (1) Picture naming task in L2 and (2) article naming task in L1.

Task 1: Picture naming task in L2. The objective of this task was to produce inhibition of the nouns in Italian-L1. Participants had to name pictures in Spanish-L2, and they were instructed to name them as quickly and accurately as possible using the bare noun (i.e., without using the define article "el" or "la" in Spanish). A trial consisted of the following events: A fixation point (+) presented at the center on screen for 750 ms; presentation of the picture until the participants' response or for a maximum of 4000 ms; and a blank interval for 750 ms before the next trial. A practice block of 12 trials was administrated before starting the task. Naming latencies were measured from the onset of the stimuli until the beginning of the response. Naming errors and equipment failures were registered.

Task 2: Article production task in L1. The objective of this task was to measure the speed of access to the grammatical gender information of those nouns practiced during the previous task in L2. For that, the participants had to retrieve and name the definite article corresponding to the presented pictures (the same practiced in L2 during the previous task plus the new control items). Each trial consisted of the following sequence of events: A fixation point (+) for 750 ms; the presentation of the picture that remained on the screen until response or for a maximum of 4000 ms; and a blank interval for 750 ms. Finally, an L2 subjective questionnaire was administered.

Results

Task 1: Picture naming task in L2. Several types of responses were excluded: (1) Naming latencies below 300 ms and exceeding 2500 ms, (2) naming errors and verbal dysfluencies, (3) Spanish words unknown by the participant. Overall, 24.11% of the trials were excluded from the analyses [70% of that percentage was due to non-responses, and these trials were not included in the analyses of the second task (see below)]. An ANOVA introducing Grammatical Gender (Congruent vs. Incongruent) and Number of Presentations for each picture (1 vs. 5) revealed a main effect of Grammatical Gender [F (1, 31) = 4.367, MSE = 2.954, p = .004], with congruent items 20 ms faster than incongruent ones [884 ms (SD = 176) and 904 ms (SD = 177), respectively]. The main effect of Number of Presentations was also significant [F (1, 31) = 183.474, MSE = 11.525, p = .0001], revealing faster naming latencies with pictures practiced more times [1022 ms (SD = 131) and 756 ms (SD = 110), for pictures practiced once or five times, respectively]. Finally, the interaction between the variables was not significant [F (1, 31) = 0.855, MSE = 4.565, p = .362].

Task 2: Article production task in L1. Naming errors (8.37% of the trials), verbal dysfluencies, response times below 300 ms and exceeding 2500 ms, and naming latencies for those pictures that were never successfully named during the previous task in L2 were eliminated from the analysis (overall, 31.34% of the trials). Naming errors included cases where the participants produced the wrong name of the picture as well as the wrong article (unfortunately our coding system did not permit to separate the two types of naming errors). An analysis of these combined errors comparing the Congruent and Incongruent conditions showed that incongruent nouns produced significantly more errors than congruent ones (109 and 64, respectively) [F (1, 31) = 12.1304, MSE = 2.6084, p = .001]. Regarding the latencies for the article production, an ANOVA including Grammatical Gender (Congruent vs. Incongruent) × Number of Presentations (0, 1, and 5) showed a main effect of Grammatical Gender [F (1, 31) = 19.684, MSE = 19.429, p = .0001], Number of Presentations [F (2, 62) = 10.021, MSE = 14.039, p = .0001], and the interaction of Gender × Number of Presentations [F (2, 62) = 11.554, MSE = 11.163, p = .0001].

In order to understand this interaction (see Figure 16), we compared, first, congruency effects for each level of repetition. Planned comparisons yielded significant differences between congruent and incongruent items practiced once in L2, with slower RT in the incongruent condition [1089 ms (SD = 203) and 1200 ms (SD = 195); F (1, 31) = 17.224, p = .0002]. This difference was also significant when the pictures were practiced five times [1091 ms (SD = 196) for congruent and 1257 ms (SD = 213) for incongruent; F (1, 31) = 27.074, p = .0001], but not when the pictures were practiced zero times [1241 ms (SD = 220) for

congruent and 1231 ms (*SD* = 193) for incongruent; F (1, 31) = 0.100, p = .752]. Note that non-repeated pictures were never named in L2, and therefore they were never subject to interference. Because article production for these new pictures was performed in L1, it is not surprising that congruency effect were not present. However, when the pictures were named in L2 and they were incongruent, the more times the pictures were named in L2, the harder to find the appropriate article in L1. That is, the gender congruency effect became larger with repetitions because incongruent articles were harder to retrieve.

When we compared 1 vs. 5 L2 naming for congruent and incongruent items, repetition effects were only present for the incongruent condition[11]. The results of these comparisons indicated that for incongruent nouns significant differences between pictures practiced one and five times in L2 were obtained, with slower RT for the pictures practiced five times [1200 ms (*SD* = 195) and 1257 ms (*SD* = 213); F (1, 31) = 4.896, p

[11] It could be argued that the proper comparison to claim inhibitory effects is the comparison between zero and five repetitions. In fact, RIF effects in standard memory procedures with categorical materials come from comparing practiced items from practiced categories to items belonging to unpracticed categories. However, we think that in the present procedure the proper comparison involves one to five repetitions. Standard RIF with categorical material involves the presentation of common familiar concepts, whereas the L2 picture naming task in the present experiment (see also Levy et al., 2007) involves the presentation of new unfamiliar pictures (depicting common objects). Hence, the first naming trial would increase the familiarity with the picture and produce facilitation (see Johnson & Anderson, 2004; and Levy et al., 2007, for further discussion and similar results in other inhibitory paradigms). Although not significant ($p > .05$), Figure 16 shows that RT to items named for the first time is faster than the RT to new items, these differences in perceptual familiarity may obscure inhibitory effects when comparing 0–5 repetitions in incongruent trials ($p > .05$). However, the inhibitory effects clearly emerge when comparison involve already familiar items (1 vs. 5 presentations).

= .03]. In contrast, this difference was not significant for congruent items [1089 ms (*SD* = 203) for one repetition and 1091 ms (*SD* = 196) for five repetitions; $F(1, 31) = 0.006$, $p = .93$]. This pattern indicates that the congruency effect was driven by an increased interference in the incongruent condition with more repetitions, and not by facilitation in the congruent condition across repetitions.

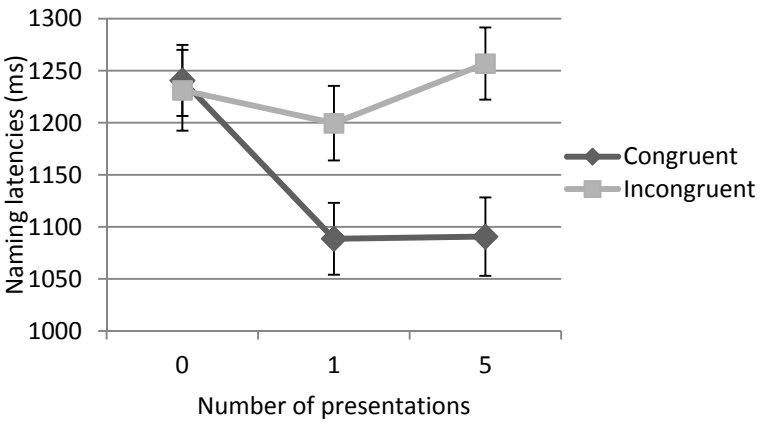

Figure 16 | *Response latencies (in ms) producing the L1 definite article for those pictures presented 0, 1 or 5 times in the previous L2 picture naming task.*

DISCUSSION

The aim of this study was to demonstrate that not only the two gender systems of a bilingual are functionally connected, but also that this co-activation can cause competition processes that are resolved by inhibitory mechanisms at the grammatical level of representation. In the first phase of the experiment, we found that participants took more time naming pictures with incongruent Italian–Spanish gender. Furthermore, this effect was

observed through a bare noun picture naming task in which explicit access to the grammatical gender information of each word is not mandatory. This result supports the notion that grammatical gender selection is not constrained to noun phrase production tasks, in which explicit access to the gender representation is required (i.e., when participants are asked to name pictures using the gender-marked definite article; Cubelli et al., 2005; Paolieri, Cubelli, et al., 2010; Paolieri, Lotto, et al., 2010), and that grammatical gender is a lexical property that is automatically activated and interacts across the bilinguals lexical systems (Bordag & Pechmann, 2007; Lemhöfer et al., 2008; Paolieri, Cubelli, et al., 2010). Although we do not have a monolinguals control condition in the experiment to show that the effect is really due to between-language activation in bilinguals and to possible differences between gender congruent and incongruent words, Paolieri, Lotto, et al. (2010) tested Italian monolingual participants with similar materials and showed that this effect was not present in monolinguals. In summary, results from task 1 suggest that grammatical gender is an intrinsic part of the lexical representation, and it is always available when a noun is retrieved. Therefore, gender effects should be observed in all tasks requiring lexical access, whether producing a noun phrase with explicit gender markers or the bare noun along.

In our study, between-language gender incongruency introduced competition so that when there was no agreement between Italian–Spanish gender for the corresponding object, naming latencies were slower than when there was agreement between them. This between-language competition at the grammatical level seems to have triggered inhibitory processes. Then, the interference created by gender incongruency was resolved by

inhibiting grammatical gender representation of the Italian-L1 words in order to facilitate the correct naming of each picture in Spanish-L2. Because of this inhibition, later retrieval of L1 grammatical information (retrieving the appropriate article) of incongruent words took longer relative to the retrieval of the appropriate article for gender congruent pictures.

According to the IC model (Green, 1998); bilinguals trigger inhibitory control mechanisms to select the desired representations when they experience between-language competition. In this study we show that during an L2 naming task both L1 and L2 lexical representations are activated and compete, in particular this competition is evident when the grammatical gender information in the two languages is incongruent. The results of the picture naming task demonstrate that the participants took more time naming the pictures when the grammatical gender of the corresponding names was incongruent than when it was congruent. This congruency effect demonstrates that L1 was activated even when only L2 was needed for naming and that this activation included grammatical features.

More importantly, results of the second task involving retrieval of the article in L1 indicate that the grammatical competition during L2 naming was resolved by specifically inhibiting the competing grammatical gender in L1. Note that in the article naming task access to the gender information was needed, and therefore it is a task that specifically taps gender processing, in order to measure the access of gender representation properly (see Bajo et al., 2006, for the importance of task specificity to test inhibition). Although we found a significant gender congruency effect between objects practiced once and five times, the fact that

this effect in L1 is larger as the number of repetitions in L2 increases clearly show that this gender congruency effect is the result of the previous naming in L2. In addition, the absence of such effect with pictures never presented for L2 naming also signals that the slower response times with repetition are due to the mechanism involved in reducing gender interference during picture naming. Nevertheless, direct evidence in favor of an inhibitory account is provided when we focus on the effect of repetition on incongruent pictures and the increment in L1 article retrieval for pictures named five times in L2. The fact that this effect was absent for congruent objects tell us that the impairment is caused for the competition arisen for the incongruent between-language gender for the nouns, and not for facilitatory effects in the congruent condition.

However, it could be argued that this data are open to alternative explanations. First, it could be argued that the congruency effect is not due to the co-activation of grammatical features that compete for selection, but to the effect of determiners similarity. This might be the case because of the particular form of the determiners used in Spanish and Italian. Thus, in Spanish they are "el" for masculine and "la" for feminine, whereas in Italian there are "il"/"lo" for masculine and "la" for feminine. So, the incongruency effect could be interpreted as due to the similarity in word form of the Spanish and Italian feminine determiners. To rule out this alternative explanation we performed additional analyses introducing gender as a variable. If the gender effect was due to form similarity we should find that in the L2 naming task the masculine condition should produce longer effects than the feminine condition. The results of the ANOVA on the L2 naming times with Gender, Congruency, and Repetition as independent

variables showed a main effect of Congruency [F (1, 31) = 5.3811, p < .05], and Repetition [F (1, 31) = 173.934, p < .05]. However, Gender (feminine vs. masculine) was not significant and did not interact with any of the other variables (all ps > .05). This suggests that the congruency effect was not due to form similarity, but to gender incongruency. In addition, the ANOVA performed in the article naming task of the second phase showed that the critical Gender × Congruency × Repetition interaction was not significant [F (2, 56) = 0.276, p >.05]. Indicating that Congruency × Repetition (the inhibitory index) was similar for both feminine and masculine.

Similarly, it could be argued that the effect of repetition in incongruent trials might be due to associative interference. Within the memory field, some have argued that the forgetting induced by retrieval of information is due to the strengthening of the practiced items with the contextual cue, so that when that cue is later presented for recall, the strengthen representation is activated first and block the retrieval of the non-practiced items (Raaijmakers & Shiffrin, 1981). In this context, this associative account would suggest that practice in L2 naming would strengthen the relation between the presented pictures and the L2 name, so that later, when participants saw the pictures again the strengthen L2 representation would come to mind and block the retrieval of the L1 representation. In the memory literature, this interpretation has been ruled out by showing that retrieval induced forgetting is also produce when the task used to capture forgetting of the unpracticed items does not test the strengthened relation. This is done by presenting either novel cues (Anderson & Spellman, 1995; Bajo et al., 2006) or item specific tests (Román, Soriano, Gómez-Ariza, & Bajo., 2009). Although our procedure is

not exactly cue independent, in our experiment the particular tasks used during the first and second phase were selected so that associative interference was not present. Thus, in the first phase a bare noun naming task was used to avoid the presentation of the L2 determiner, whereas in the second phase we asked participants to only name the L1 determiner corresponding to the object in the picture. Hence, the picture and the L2 determiner were never presented together during the first phase to produce strengthening of the picture-determiner representation. Hence, the relation between the picture and the L2 determiner was never strengthened and there are no reasons to think that the determiner in L2 was blocking retrieval of the L1 determiner.

Hence, the results speak in favor of the importance of inhibitory control mechanisms in resolving between-language competition in bilinguals at the grammatical gender level. Levy et al. (2007) observed co-activation at the phonological level and were able to show that phonological competition was resolved by means of inhibition of phonological representations. In our experiment, we were able to find a similar pattern of inhibition at the grammatical gender level. Together, both studies highlight the importance of executive control mechanisms for controlling language production in bilinguals.

In conclusion, grammatical gender information is a lexical representation that is automatically activated and can cause competition between-languages with similar gender systems. This interference seems to be solved by inhibitory mechanisms that suppress momentarily the grammatical gender representation of specific lexical entries. Although more research is needed to isolate the specific inhibition of competitive traces,

the fact that competition processes are required for inhibition to occur seems to be clear.

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Chapter VII

General Discussion

The aim of the present thesis was (i) to explore the role that grammatical gender plays in the process of lexical access in monolingual and bilingual speakers, and (ii) to study some of the cognitive mechanisms involved in the control of languages in bilinguals at this level of representation. In this final chapter, we present a general overview and discussion of the main findings of our studies, which will be organized around the main research topics included in the Introduction. Finally, a brief outline of some future research questions is included at the end of the chapter.

The studies included in this thesis aimed to investigate the process of lexical access in monolingual and bilingual speakers of Romance languages at the level of grammatical gender. With this purpose in mind we introduced several interference tasks in which speakers processed words with congruent or incongruent gender value with respect to a distractor word or in relation to the corresponding translation into another language. In the final empirical chapters of the present dissertation we also tried to answer specific questions regarding the mechanisms of language control and language selection at this representational level.

After reviewing previous empirical data and theoretical approaches in Chapter I and II, Chapter III presents empirical evidence of how grammatical gender is represented and accessed within the lexical system in Italian and Spanish languages. With this basis, in Chapter IV we investigated whether the native knowledge of grammatical gender affects L2 processing in speakers of these two languages. In addition, in Chapter V we extended this question to speakers with English as their L2, a language in which grammatical gender is not present for nouns. We also evidenced that an experience of language immersion can modulate between-language activation at this level. Finally, in Chapter VI we explored whether inhibitory processes are involved in language selection when grammatical gender specifically acts as a source of between-language competition.

GRAMMATICAL GENDER WITHIN THE LEXICAL SYSTEM

In many languages, nouns have grammatical gender, and certain words must be marked for gender agreement. However, in many

of these gendered languages the link between grammatical gender and word meaning is unpredictable. Producing words is an essential part of producing discourse. During production the speaker has to retrieve words with all the necessary phonological and morphosyntactic information to achieve agreement in the sentence. Numerous studies have evidenced that lexical access in language production occurs first during selection of semantic and syntactic representations, and then during selection of the phonological content (Caramazza, 1997; Dell, 1986; Levelt, Roelofs, & Meyer, 1999; Levelt, 1989; Roelofs, 1992). But what is the stage during lexicalization where grammatical gender is represented? The distinction between gender and phonological representations is supported not only by studies on language production (Schriefers & Jescheniak, 1999), but also by research with aphasic patients (Badecker, Miozzo, & Zanuttini, 1995) and with normal speakers experiencing the tip-of-the-tongue state (Miozzo & Caramazza, 1997) are consistent with the distinction between gender and phonological representations. The most prominent psycholinguistic models postulate that grammatical gender is represented as a single node connected to all nouns belonging to the same category (e.g. masculine or feminine in the case of Romance languages) (Caramazza, 1997; Levelt et al., 1999). The WEAVER++ model (Levelt et al., 1999) assumes that activation of gender precedes the selection of the lexeme node. However, because the connections between nouns and gender nodes are unidirectional, gender activation has no effect on the level of activation of other words with the same gender. The IN model (Caramazza, 1997) assumes that gender selection is an automatic process occurring after phonological-lexical selection, and that the production of isolated nouns should occur without selection of grammatical gender. But, importantly, both models

assume that grammatical gender is selected only in producing gender-marked utterances, and that access to the phonological form of a noun without gender selection is possible when no syntactic agreement is required. In consequence, these theories predict no effect of grammatical gender in bare noun production tasks.

The experiments reported in Chapter III, however, clearly show that grammatical gender is a property of nouns that can be selected even outside phrasal contexts. Therefore, the lexical access of Italian (Experiment 1) and Spanish (Experiment 2) speakers was influenced by the presence of words that were similar or dissimilar in gender relative to the target noun. Their picture-naming latencies were slower when the words to be ignored shared gender with the nouns of the pictures. Conversely, their responses were speeded up when pictures' nouns and distractor's words were incongruent in gender. Because our participants were instructed to name the pictures using the bare nouns, and thus explicit access to the gender information was not required, we interpret our results as evidence of grammatical gender being an inherent lexical representation of all nouns (Alario, Matos, & Segui, 2004; Cubelli, Lotto, Paolieri, Girelli, & Job, 2005; Cubelli & Paolieri, 2008; Gollan & Frost, 2001; Paolieri, Lotto, Leoncini, Cubelli, & Job, 2011), and not as an independent node attached to them. Therefore: (i) contrary to WEAVER++ model (Levelt et al., 1999), and at least in Romance languages, the selection of a noun's gender is mandatory even outside sentential contexts; and (ii) in contrast to IN model (Caramazza, 1997), the selection of grammatical gender is not an automatic but a competitive process that precedes phonological selection.

It is important to note that these models are based on a series of studies that show an absence of gender effects in bare noun production in Germanic languages (La Heij, Mak, Sander, & Willeboordse, 1998; Starreveld & La Heij, 2004). However, and unlike Romance languages, in these languages grammatical gender has no consequences for the form of the nouns, given that most nouns are not overly marked for gender. Consequently, semantic information could be enough to access the targets' phonological form. In contrast, in Romance languages (like those involved in Experiments 1 and 2) almost all nouns have complex morphological structures, and suffixes are strictly related to the grammatical gender. In consequence, gender effects become visible, reflecting the selection of nominal endings. This assumption was proposed by Cubelli and colleagues based on experiments with Italian-speaking participants, and support the idea that gender effects in picture-word tasks depend on the specific, formal, morphosyntactic properties of languages (Cubelli et al., 2005). Our results seem to agree with this explanation, replicating their findings with another group of Italian speakers (Experiment 1). But, importantly, our Experiment 2 adds to the evidence by showing a similar gender effect in Spanish speakers, another Romance language with a nominal gender system quite similar to the Italian one. Therefore, although the experimental results can vary according to the constraints imposed by language-specific properties, the processing of grammatical gender seems to be supported by universal mechanisms. Consequently, Psycholinguistic models should include the representation of grammatical gender as an abstract lexical feature to better describe the lexical representation of all nouns.

As we presented in the Introduction, a first approach to the structure of lexical entries distinguished only two levels of representation: the lemma, comprising meaning and syntactic information, and the lexeme, describing morphological and phonological features (Levelt & Schriefers, 1987; Levelt, 1989). Thus, grammatical gender was represented as an intrinsic property of all nouns, and not as a single node connected to all nouns belonging to the same category. Our results and others (Cubelli et al., 2005; Paolieri et al., 2011) seem to be consistent with this perspective, assuming that grammatical gender is an inherent representation existing in all nouns and that its selection is mandatory in the process of lexical access. According to the double-selection model (Cubelli et al., 2005), in order to produce a given noun, both the semantic (meaning) and syntactic (grammatical properties) information has to be selected prior to accessing its phonological form. Thus, access to the phonological-lexical form is achieved only when both components are selected.

In the picture-word paradigm, the selection of the name of the picture partly depends on the level of activation of the lexical node corresponding to the distractor word. With the experiments reported in Chapter III we demonstrate that bare noun production in Romance languages is influenced by the gender congruency between target and distractor, with slower naming latencies when both elements belong to the same gender class. Therefore, the fact that the distractor noun shares gender with the target noun enhances its degree of activation, with the selection of the target becoming harder compared to when both stimuli are different in gender. Although the picture-word interference task provides an attractive tool for the study of

lexical access at the gender level, a different approximation to test these assumptions is by using tasks in L2. In this case, bilingual speakers are asked to perform a task using their second language (e.g. to name pictures in L2 or to translate words) providing us with important information on how grammatical gender is represented within the lexical system.

WHAT BILINGUALISM TELLS US ABOUT GRAMMATICAL GENDER

As we have pointed out, the use of tasks in L2 provides important information about the architecture of the bilingual lexical system and, specifically, the way in which grammatical gender is represented and accessed during lexical access. It is well established that bilinguals activate their two languages in parallel during reading, speaking, and listening (Dijkstra, 2005; Hoshino & Thierry, 2011; Kroll, Sumutka, & Schwartz, 2005; Marian & Spivey, 2003). It follows that if the two lexical systems are connected, L1 features would affect L2 processing. But more importantly for our purposes here, if grammatical gender is represented as an abstract feature of all nouns, an effect of grammatical gender should be observed when the names of the words vary in gender class between the two languages. Although the bilingual studies reported in this thesis aimed to investigate other aspects of bilingual gender processing besides language interactions at this level (e.g. transfer effects between languages or the involvement of inhibitory control on bilingual lexical selection), all of them provided evidence regarding language co-activation at the gender level. Thus, because the properties of the native language of our participants affected their processing in L2, we can assume that both languages are connected at the level

of grammatical gender. Many of the experiments reported in this thesis have shown that Italian-Spanish bilinguals are influenced by the native grammatical gender when performing comprehension tasks (Experiments 3 and 4) and production tasks (Experiment 7) in their second language Spanish. In addition, they show that Spanish-English bilinguals are also affected by their native gender knowledge while performing a task in their L2 English (Experiment 6), a language in which this feature is not even present for nouns. Overall, all these results are congenial with models assuming non-selective activation in bilinguals (e.g., Kroll, van Hell, Tokowicz, & Green, 2010), and demonstrate that both lexical systems are connected at the level of grammatical gender.

In the same way, other studies have reported between-language gender interactions, and they seem to indicate that these connections are independent of the language combination and the type of response, i.e., whether noun phrases or bare noun responses are required (Alario et al., 2004; Bordag & Pechmann, 2007, 2008; Lemhöfer, Spalek, & Schriefers, 2008; Paolieri et al., 2010; Salamoura & Williams, 2007). Again, the results of Experiments 6 and 7 replicate these findings and show that gender effects are also present when bilinguals have to respond using nouns in isolation. This pattern suggests that bilingual speakers are not exempt from the gender influence of their native language when performing a task in L2 and that this effect is not limited to gender-marked utterances. Since the gender effect has been found in bare noun production, this suggests that grammatical gender is a lexical property of all nouns that is always available even when syntactic agreement is not required.

Co-activation and between languages interaction at the level of grammatical gender seem to be a well-established process. However, the experiments included in Chapter IV aimed to extend the study of these interactions to speech recognition in L2. Although the influence of L1 gender information on L2 has been previously reported in production and comprehension tasks (e.g. Paolieri et al., 2010; Sabourin & Stowe, 2008), our experiments add new evidence to previous studies that investigated these processes only under the perspective of the visual-comprehension domain (i.e. written-word recognition). Hence, the use of eye-tracking methodologies provided us with a valuable measure of real-time processing that revealed the existence of cross-linguistic gender interactions and access to the gender information independently of any morphological marker (Gollan & Frost, 2001). In Experiments 3 and 4 we again observed a significant interaction of the lexical systems of the bilinguals at the level of grammatical gender. In this case, the proportion of fixations to the target referent was impacted by the gender incongruency of the picture's noun, and the bilinguals reduced the number of fixations to the referent when it was incongruent in gender between Italian and Spanish. Moreover, our results tell us about the temporal dynamics of the gender effect. Thus, when exploring the time course of the referent resolution, the pattern suggests that gender co-activation arises early during the sentence processing, and that shortly after, L2 gender processing becomes evident.

The fact that the presence of overt gender marking facilitates the processing of subsequent words has been widely studied in adult and child monolinguals (Bates, Devescovi, Hernandez, & Pizzamiglio, 1996; Dahan, Swingley, Tanenhaus, & Magnuson,

2000; Grosjean, Dommergues, Cornu, Guillelmon, & Besson, 1994; Lew-Williams & Fernald, 2007; van Heugten & Johnson, 2011; Wicha, Moreno, & Kutas, 2004). There is also recent evidence showing that bilinguals can use marks of L2 grammatical gender to facilitate L2 speech processing (Dussias, Valdés, Guzzardo, & Gerfen, 2013; Lew-Williams & Fernald, 2010). Thus, these studies have shown that the presence of prenominal gendered modifiers results in a significant facilitation for lexical access of upcoming target items. Crucially, our different-gender condition in Experiment 4 matches this situation and speakers benefited from the processing of the gender marked determiners in the interpretation of the speech instruction.

All this evidence speaks in favor of the existence of a grammatical gender system that interacts between the two lexical systems of the bilinguals. In parallel, they do not support the proposal by Costa and colleagues (Costa, Kovacic, Franck, & Caramazza, 2003) suggesting that the gender systems of the bilinguals are autonomous. Our results, however, cannot clearly answer the question whether there is one single integrated gender system (Salamoura & Williams, 2007), or whether the gender information specified at the lexical representations is linked between languages. Nevertheless, these results are consistent with the proposal that selection of lexical nodes involves access to their syntactic features (Cubelli et al., 2005). Therefore, in an L2 task, pictures activate the lexical representations of nouns in both languages. Since both lexicons are connected, the more similar the two nouns are, the more activated the L2 noun will be. Consequently, when a word is congruent in gender between two

languages, the L2 noun should receive more activation, thus facilitating lexical selection.

As we have already discussed, empirical studies concerning gender effects in bilinguals have revealed that it does not depend on the different morphological systems in Germanic and Romance languages (Bordag & Pechmann, 2007; Paolieri et al., 2010). In Experiment 6 we wanted to explore whether the gender effects can be observed in a second language lacking a grammatical gender system for nouns (i.e., English). Spanish-English speakers cannot share a single gendered system between the two languages, since their L2 lacks grammatical gender. Nevertheless, empirical evidence has revealed the existence of transfer effects from a gendered language to a non-gendered language at this level of representation (Boutonnet, Athanasopoulos, & Thierry, 2012; Ganushchak, Verdonschot, & Schiller, 2011; Midgley, Wicha, Holcomb, & Grainger, 2007; Sabourin, Stowe, & de Haan, 2006). Specifically, the results of our Experiment 6 support these findings, since Spanish-English bilinguals were affected by the gender of L1 while naming pictures in English (although in this experiment we also varied the language immersion experience; we will go back to this issue in the next section). Therefore, their linguistic production was influenced by the gender value of a distractor word even when access to this feature was not required (they had to produce the bare noun of the pictures) and they had to name in a language lacking this information. We believe that the conflict in this task resulted from a co-activation of the Spanish and English linguistic systems, and from the transfer of Spanish gender features to English grammar. This result is again congenial with models of non-selective activation. But more importantly for our

aims, this experiment supports once again the notion that gender effects arise at the lexical level. It is important to note here that this study, although performed by bilinguals, parallels the monolingual gender congruency effect (Experiments 1 and 2). Since the English-L2 of the participants lacks grammatical gender, only a transfer of gender from L1 to L2 can account for our results. The participants in the Experiment 6 were asked to name the pictures by using the bare noun, and explicit access to the gender information of the nouns was not required. Therefore, these findings again support the idea that grammatical gender is represented as an abstract lexical feature of nouns, and that its selection is mandatory whenever lexical access occurs. This conclusion is consistent with a recent study by Boutonnet and colleagues (Boutonnet et al., 2012), who found that Spanish-native English learners unconsciously retrieved grammatical gender of nouns during semantic processing even when such information was task-irrelevant. Also, Ganushchak and collaborators (2011) found that Dutch-speaking participants transferred grammatical gender information to English during a nonlinguistic task. Overall, this evidence shows that the native gendered system can be transferred to English although the latter does not have grammatical gender in its nominal system. But, crucially, they provide evidence for spontaneous access to this representation even in a context which does no require access to such information.

Overall, all the experiments included in this dissertation seem to demonstrate that grammatical gender is not represented as an independent feature of nouns. Conversely, our results defend the idea that grammatical gender is an intrinsic representation of all nouns, and that this is always available even when processing

isolated nouns. In addition, the results indicate that the two lexical systems of a bilingual are connected at the level of grammatical gender, and that this is a property that can cause interference and competition during lexical access. Thus, we have found that the gender incongruence of nouns delays lexical selection in bilinguals, forcing them to solve the competition at this level of representation between the different active lexical entries. Although Experiment 6 points out the existence of some factors modulating cross-language activation, Experiment 7 specifically explores which type of cognitive mechanism is in charge of resolving the interference produced at the level of grammatical gender in bilinguals. We will deal with processes of lexical selection in the last section of the General discussion.

MECHANISMS AND FACTORS INFLUENCING LANGUAGE SELECTION IN BILINGUALS

Although sometimes early language selection may occur (e.g. when bilinguals with an L1 stronger than an L2 speak in their native language) (La Heij, 2005), our experiments and other numerous studies show that the two languages of the bilinguals become active in parallel and compete with one another during comprehension and production (for a recent review see Kroll, Dussias, Bogulski, & Valdés, 2012). Nevertheless, it is important to remark that some factors (i.e. language proficiency, the availability of cognitive resources, etc.) can constrain and modulate the activation of the two languages (Kroll, Bobb, & Wodniecka, 2006). Specifically, in Experiment 6 we found transfer effects of specific language properties from L1 to L2, but these transfer effects were influenced by language immersion. Although L2 immersion has been demonstrated to benefit the

acquisition of oral proficiency (Freed, 1995), little evidence has explored its consequences for the processes engaged in speech planning. In this way, a recent study by Linck and collaborators (Linck, Kroll, & Sunderman, 2009) suggested that L2 immersion facilitates the learning of a second language as a result of the suppression of the native language. Consequently, the activation of the more dominant L1 is reduced, and its negative influence on L2 becomes attenuated. In Chapter V we presented evidence of Spanish-English speakers being influenced by the grammatical gender of their native language during a production task in L2. Thus, the participants were slower naming pictures in English when paired to distractor words that shared gender with the target noun. In contrast, this influence was not observed in a group of participants immersed in an L2 context at the moment of the experiment. In this case, their naming latencies were not affected by the gender relationship of the target and distractor noun, demonstrating that immersion can restrict the influence of the native language on L2 processing. This result is important because it adds to the evidence by showing that immersion experience modulates the activation of the more dominant language during spoken production. Although our results are congruent with the inhibitory account provided by Linck (2009), they can also be explained by other mediating factors. First, being in an L2 environment may have reduced the frequency of use of the native language, so that L1 becomes less accessible –but not completely inhibited– during the L2 immersion experience (Gollan, Montoya, Fennema-Notestine, & Morris, 2005). Second, the immersion experience may have induced in the bilinguals an L2 mental set that makes it difficult to switch into an L1 set while immersed (Meuter & Allport, 1999; but see Kroll, Bobb, Misra, & Guo, 2008). Although the current study does not allow the

adoption of a strong position regarding any of them, we can, however, conclude that (i) loss of access to the native language is produced during immersion in a second language context, and (ii) immersion context modulates cross-language interactions by reducing between-language competition.

Overall, these results are consistent with the literature showing that bilinguals must launch inhibitory processes to suppress one of the languages when using the other (Abutalebi & Green, 2008; Levy, McVeigh, Marful, & Anderson, 2007; Martín, Macizo, & Bajo, 2010), since the observation that the intention to speak in one language does not limit the activation of the alternative language led to the proposal that bilinguals possess a cognitive mechanism that manages to control language selection (Green, 1998). This model suggests that bilinguals need to inhibit the language not in use to enable language selective access. Therefore, although initially lexical entries of both languages are active, inhibitory control would be exerted on the more dominant and competing language (i.e. L1, usually), which in turn leads to a greater cost in reactivating the native language when it is again needed. This is in contrast to other models which argue that despite cross-language activation, language-specific selection is possible because the lexical entries corresponding to the alternative language are not considered for its selection (Costa, Miozzo, & Caramazza, 1999). However, the evidence discussed in the empirical chapters of this thesis seems to disagree with the latter position, since bilingual language processing was significantly affected by the influence of the native language. Moreover, in Experiment 7 we present evidence demonstrating that Italian-speaking learners of Spanish managed to solve the competition arising at the grammatical gender level

by reducing the negative influence of their native gender when it was a source of interference between languages.

The gender (in)congruency effect in bilinguals results in a negative influence on the bilingual linguistic performance when nouns do not share gender between languages (Paolieri et al., 2010). We were able to replicate this pattern of gender competition with Italian-Spanish participants in the experiments included in Chapters IV and VI. But more importantly, Experiment 7 was specifically designed to explore the involvement of inhibitory mechanisms on the resolution of gender effects in bilinguals. We found that Italian-Spanish bilinguals were slower accessing the L1 grammatical gender of a series of pictures when they were previously asked to name them in L2, and this effect was stronger for those nouns incongruent in gender between the two languages. Thus, in task 1 we asked participants to produce the name of a series of pictures that could be either congruent or incongruent in gender between the two languages. Crucially, pictures were practiced 1 or 5 times. The main prediction was that the higher number of naming trials in L2, the greater inhibition of L1, which would specifically act at the grammatical gender level in order to resolve the competition arising at the grammatical level (Levy et al., 2007). After this naming phase, participants were asked to produce in their native L1 the definite articles of the same pictures that they previously practiced in L2. Results revealed a grammatical gender congruency effect that increased for those words practiced five times in L2. Therefore, our results support the existence of an inhibitory mechanism that might be involved in the suppression of the native gender features during language production in bilinguals.

The procedure we used to study the inhibition of grammatical gender in bilinguals comes from the *Retrieval Induced Forgetting* paradigm (Anderson, Bjork, & Bjork, 1994), which explains forgetting based on the observation that the recall of specific information impairs subsequent retrieval of related knowledge. Thus, we extended the RIF paradigm to the case of bilingualism, which allowed us to obtain two independent indexes. First, the interference effect found in task 1 was taken as an index of non-selective activation and between-language connections at the level of grammatical gender. Second, the additional time observed in task 2 to reactivate the incongruent nouns more practiced in the previous task, was taken as an index of the inhibition of the gender representations of the nouns. This methodological feature has advantages over those indirect measures of inhibition used in previous studies (Meuter & Allport, 1999). In addition, most of the studies evidencing inhibition in bilinguals come from studies using mixed language conditions (Christoffels, Firk, & Schiller, 2007; Costa & Santesteban, 2004; Meuter & Allport, 1999; Verhoef, Roelofs, & Chwilla, 2009), which possibly increases the level of activation of the two languages and biases the cross-language interaction (Wu & Thierry, 2010). In our study, however, task 1, which was critical to create between-language gender competition, was carried out in only one language context (i.e. the participants' L2 Spanish). This procedure is consistent with a new set of empirical research studying language inhibition in bilinguals without affecting the language mode of the interlocutor during the critical condition (Levy et al., 2007; Macizo, Bajo, & Martín, 2010; Martín et al., 2010).

To summarize, the joint activation of the two languages in bilinguals requires an active mechanism that negotiates the cross-language activation and facilitates language selection. Evidence suggests that the act of planning speech in a second language requires the inhibition of the native language, which then has negative consequences for speech planning in L1 (see Kroll et al., 2008). Our results seem to agree with the inhibitory account of language selection in bilinguals, a perspective that has also received support from studies using event-related brain potentials (ERPs) and functional magnetic resonance imaging (fMRI) (e.g. Rodriguez-fornells et al., 2005). Moreover, language non-selectivity activation seems not to be a rule, since there are conditions that restrict speech planning to one language (Kroll et al., 2006). One example is that being immersed in a second language country can constrain the activation of the native language by inhibiting its level of activation (Linck et al., 2009). Overall, from this perspective it is not surprising that bilinguals develop abilities for negotiating cross-language competition that confers them enhanced cognitive control (Bialystok, Craik, Klein, & Viswanathan, 2004; Costa, Hernández, & Sebastián-Gallés, 2008), since brain areas associated with inhibitory processing function seem to be recruited by bilinguals to select the appropriate language (Abutalebi & Green, 2007, 2008).

CONCLUDING REMARKS AND FUTURE RESEARCH QUESTIONS

In the present dissertation we have attempted to provide evidence regarding the influence of grammatical gender on lexical access in monolingual and bilingual speakers. We also wanted to explore whether inhibitory mechanisms are involved

in language selection at the gender level and how language immersion modulates language access at this level of representation. The results of the 7 experiments reported in this thesis evidence that grammatical gender is an intrinsic property of nouns and that its selection is a competitive process during lexical access in monolingual and bilingual processing. Moreover, our results suggest that this feature of nouns can be transferred and influence lexical access in a second language like English, which lacks this information. Finally, our results also speak in favor of the involvement of the inhibitory control to overcome the between-language gender interference observed in bilingual speakers. However, several research questions are not fully addressed in this work, and they would provide new insights into the main research topics covered in this thesis.

First, it is important to bear in mind that bilinguals vary multi-dimensionally on linguistic factors (not to mention other variables). Therefore, the pattern of results that we found in our experiments may differ if different types of bilinguals are considered (e.g. Festman, Rodríguez-Fornells, & Münte, 2010; Luk, De Sa, & Bialystok, 2011; Sebastián-Gallés, Echeverría, & Bosch, 2005). Thus, we consider it relevant to better investigate whether proficiency and some other factors related to the bilingual experience modulate both cross-language activation generally and cross-gender interactions specifically. This issue is not new, since some approaches have tried to reconcile the different proposals about language selection in one, where bilinguals with different levels of proficiency may show differences in the pattern of language co-activation and language selection processes (Costa & Santesteban, 2004). In most of the studies presented in this thesis we have assessed the participant's

proficiency by using subjective questionnaires (e.g. Marian, Blumenfeld, & Kaushanskaya, 2007). The self-rating questionnaires have been shown to be a valuable tool for measuring language proficiency on research settings. Therefore, an interesting question would be to explore how the cross-language interaction at the gender level varies across the language history of the L2 learners. This fact may be relevant in the case of bilinguals with either similar or different gendered systems, since grammatical gender processing (and learning) seem to be affected by the morphological similarity of gender marking in L1 and L2 (Holmes & Dejean de la Bâtie, 1999; Sabourin et al., 2006).

Second, the present dissertation shows a clear influence of the native gender knowledge on L2 processing. However, these findings were observed while bilinguals processed stimuli (i.e. pictures) within an impoverished context. As we have mentioned, interlocutors incrementally process all the linguistic information as it becomes available in the speech (Chambers, Tanenhaus, Eberhard, Filip, & Carlson, 2002). In this way, it would be of interest to study the circumstances under which the gender interference effect arises. The experiments included in Chapter IV studied cross-language gender effects using invariant sentence contexts (i.e. *"encuentra la manzana"* –find the apple–). These sentences make fewer demands on cognitive processes, since words are easier to comprehend. In fact, some evidence suggests that gender agreement and semantic congruity interact during sentence processing (Bentrovato, Devescovi, D'Amico, Wicha, & Bates, 2003; Wicha et al., 2004). Therefore, by manipulating the semantic constraint and the gender congruency of the nouns in richer sentence contexts, we should be able to

observe whether the interference found at the gender level in bilinguals can be in some way impeded by the semantic information provided by the content of the sentence. Accordingly, as Experiment 3 seems to show, the inclusion of some words with similar orthographic onset between the two languages introduced a significant delay in the pattern of fixations of the participants, which emphasized the additional processing of the word-initial information (Allopenna, Magnuson, & Tanenhaus, 1998). Thus, the use of cognates in a similar experimental setting could provide us with important insights into the variables that help or hinder the gender congruency effect in bilinguals.

Third, nowadays the use of more sophisticated and modern techniques provides us with an exquisite tool to investigate the brain-related areas and the time course of a large body of processes involved during lexical access. Therefore, the implementation of event-related potentials (ERP) to our designs would allow us to better infer the temporal dynamics of the gender processing in language production. To illustrate, by using an L2 picture-word task with Spanish-English bilinguals in which semantic and gender relation is manipulated, we should observe the time-course of cross-language activation and gender competition. Because previous studies have shown that activation of languages goes beyond the first stages of lexical access (e.g. Hoshino & Thierry, 2011), we should be able to detect the time window in which grammatical gender is accessed and selected in language production.

Finally, the use of functional magnetic resonance (fMRI) might help us to understand the neural basis involved in gender retrieval, as well as the areas that differentially respond to the

gender interference and conflict in general in bilinguals. Although this is an exciting enterprise, we first hope that the empirical findings reported in the present work provide new insights regarding the influence of grammatical gender on lexical access and cognitive control in bilinguals, promoting future research to improve understanding of the functioning of the language system.

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Appendix

Stimulus Materials

Appendix A. Experiment 1.

Target picture nouns		Distractor word condition	
Nouns	Gen.	Gender congruent	Gender incongruent
letto (bed)	m.	cervo (deer)	foglia (leaf)
cappello (hat)	m.	gabbiano (gull)	tenaglia (tongs)
canguro (kangaroo)	m.	violino (violin)	pentola (pot)
trapano (drill)	m.	pomodoro (tomato)	ciliegia (cherry)
guanto (glove)	m.	sedano (celery)	calza (sock)
pinguino (penguin)	m.	tulipano (tulip)	cipolla (onion)
tamburo (drum)	m.	cavallo (horse)	pistola (gun)
martello (hammer)	m.	carciofo (artichoke)	cicogna (stork)
treno (train)	m.	casco (helmet)	rosa (rose)
cucchiaio (spoon)	m.	rubinetto (faucet)	melanzana (eggplant)
mulino (windmill)	m.	rasoio (razor)	slitta (sled)
flauto (flute)	m.	divano (sofa)	scarpa (shoe)
batteria (drums)	f.	tenaglia (tongs)	gabbiano (gull)
lampada (lamp)	f.	cicogna (stork)	violino (violin)
cintura (belt)	f.	pentola (pot)	rasoio (razor)
bottiglia (bottle)	f.	ciliegia (cherry)	pomodoro (tomato)
sedia (chair)	f.	rosa (rose)	casco (helmet)
carota (carrot)	f.	slitta (sled)	divano (sofa)
giraffa (giraffe)	f.	cipolla (onion)	carciofo (artichoke)
chiesa (church)	f.	scarpa (shoe)	sedano (celery)
camicia (shirt)	f.	pistola (gun)	tulipano (tulip)
pera (pear)	f.	calza (sock)	cervo (deer)
tromba (trumpe)	f.	foglia (leaf)	cavallo (horse)
carrozza (carriage)	f.	melanzana (eggplant)	rubinetto (faucet)
trattore (tractor)	m.	cannone (gun)	cornice (frame)
limone (lemon)	m.	cuore (heart)	palude (marsh)
bicchiere (glass)	m.	girasole (sunflower)	patente (licence)
piccione (pigeon)	m.	sangue (blood)	lavatrice (washer)
leone (lion)	m.	piede (foot)	croce (cross)
ponte (bridge)	m.	miele (honey)	siepe (hedge)
bottone (button)	m.	pugnale (dagger)	parete (wall)
ditale (fingerstall)	m.	melone (melon)	rete (net)

pettine (comb)	m.	bastone (stick)	lapide (tombstone)
maiale (pig)	m.	sapone (soap)	neve (snow)
peperone (pepper)	m.	stivale (boot)	fune (rope)
fucile (shotgun)	m.	timone (rudder)	lepre (hare)
forbice (scissors)	f.	patente (licence)	cannone (gun)
piramide (pyramid)	f.	lavatrice (washer)	girasole (sunflower)
vite (screw)	f.	palude (marsh)	cuore (heart)
falce (sickle)	f.	croce (cross)	stivale (boot)
chiave (key)	f.	lapide (tombstone)	sangue (blood)
volpe (fox)	f.	rete (net)	miele (honey)
nave (ship)	f.	fune (rope)	melone (melon)
torre (tower)	f.	siepe (hedge)	sapone (soap)
noce (walnut)	f.	lepre (hare)	timone (rudder
botte (cask)	f.	neve (snow)	piede (foot)
rondine (swallow)	f.	cornice (frame)	pugnale (dagger)
tigre (tiger)	f.	parete (wall)	bastone (stick)

Appendix B. Experiment 2.

Target picture nouns		Distractor word condition	
Nouns	Gen.	Gender congruent	Gender incongruent
cepillo (brush)	m.	gusano (worm)	mochila (rucksack)
mono (monkey)	m.	grifo (tap)	cartera (wallet)
plato (plate)	m.	conejo (rabbit)	gaviota (sea gull)
zapato (shoe)	m.	ojo (eye)	aguja (needle)
cigarro (cigarette)	m.	hombro (shoulder)	golondrina (swallow)
globo (hot-air balloon)	m.	corcho (cork)	manzana (apple)
mosquito (mosquito)	m.	tornillo (screw)	iglesia (church)
zorro (fox)	m.	espejo (mirror)	jarra (jug)
brazo (arm)	m.	escritorio (desk)	escopeta (rifle)
trompo (top)	m.	cazo (ladle)	cereza (cherry)
latigo (whip)	m.	apio (garlic)	carretera (road)
columpio (swing)	m.	sombrero (hat)	araña (spider)
queso (cheese)	m.	pato (gosling)	pata (paw)
perro (dog)	m.	cuchillo (knife)	alfombra (carpet)
cama (bed)	f.	iglesia (church)	gusano (worm)
mesa (table)	f.	gaviota (sea gull)	espejo (mirror)
tapadera (lid)	f.	araña (spider)	pato (gosling)
bota (boots)	f.	aguja (needle)	ojo (eye)
ventana (window)	f.	alfombra (carpet)	hombro (shoulder)
pierna (leg)	f.	carretera (road)	apio (garlic)
toalla (towel)	f.	manzana (apple)	corcho (cork)
paloma (pigeon)	f.	mochila (rucksack)	sombrero (hat)
cuchara (spoon)	f.	golondrina (swallow)	tornillo (screw)
bata (white coat)	f.	cereza (cherry)	conejo (rabbit)
zanahoria (carrot)	f.	escopeta (rifle)	escritorio (desk)
bufanda (scarf)	f.	jarra (jug)	cazo (ladle)
falda (skirt)	f.	pata (paw)	grifo (tap)
maleta (suitcase)	f.	cartera (wallet)	cuchillo (knife)

Appendix C. Experiment 3.

Pairs of pictures (Spanish-Italian, and English translation)	
Congruent condition	
Bufanda-Sciarpa (scarf)	Manzana-Mela (apple)
Ventana-Finestra (window)	Falda-Gonna (skirt)
Carretera-Strada (road)	Hoja-Foglia (leaf)
Cereza-Ciliegia (cherry)	Maleta-Valigia (suitcase)
Oveja-Pecora(sheep)	Pelota-Palla (ball)
Jarra-Brocca (pitcher)	Silla-Sedia (chair)
Taladro-Trapano (powerdrill)	Murciélago-Pipistrello (bat)
Loro-Pappagallo (parrot)	Cazo-Mestolo (ladle)
Ojo-Occhio (eye)	Grifo-Rubinetto (faucet)
Lobo-Lupo (wolf)	Apio-Sedano (celery)
Candado-Lucchetto (padlock)	Prismático-Binocolo (binoculars)
Búho-Gufo (owl)	Hueso-Osso (bone)
Incongruent condition	
Mono-Scimmia (monkey)	Sombrero-Cappello (hat)
Trineo-Slitta (sled)	Corcho-Tappo (cork)
Globo-Mongolfiera (hot air)	Clavo-Chiodo (nail)
Mosquito-Zanzara (mosquito)	Lazo-Fiocco (bow)
Zapato-Scarpa (shoe)	Bolo-Birillo (bowl)
Cepillo-Spazzola (brush)	Queso-Formaggio (cheese)
Mesa-Tavolo(table)	Zanahoria-Carota (carrot)
Mantequilla-Burro (butter)	Calabaza-Zucca (pumpkin)
Almohada-Cuscino (pillow)	Pata-Zampa (paw)
Seta-Fungo (mushroom)	Mariposa-Farfalla (butterfly)
Mochila-Zaino (backpack)	Iglesia-Chiesa (church)
Cama-Letto (bed)	Olla-Pentola (pot)

Appendix D. Experiment 4 & 5.

Pairs of pictures (Spanish-Italian, and English translation)	
Congruent condition	
Target	Distractor
Hoja-Foglia (leaf)	Bufanda-Sciarpa (scarf)
Berenjena-Melanzana (eggplant)	Percha-Gruccia (hanger)
Carretera-Strada (road)	Bellota-Ghianda (acorn)
Maleta-Valigia (suitcase)	Iglesia-Chiesa (church)
Zahanoria-Carota (carrot)	Oveja-Pecora (sheep)
Falda-Gonna (skirt)	Mariquita-Coccinella (ladybug)
Olla-Pentola (pot)	Mariposa-Farfalla (butterfly)
Sombrero-Cappello (hat)	Cerdo-Maiale (pig)
Prismático-Binocolo (binoculars)	Cubo-Secchio (bucket)
Búho-Gufo (owl)	Pepino-Cetriolo (cucumber)
Apio-Sedano (celery)	Cangrejo-Granchio (crab)
Grifo-Rubinetto (faucet)	Corcho-Tappo (cork)
Candado-Lucchetto (padlock)	Tarro-Barattolo (jar)
Perro-Cane (dog)	Rayo-Fulmine (lightning)
Incongruent condition	
Target	Distractor
Mono-Scimmia (monkey)	Corcho-Tappo (cork)
Mosquito-Zanzara (mosquito)	Cubo-Secchio (bucket)
Trineo-Slitta (sled)	Pepino-Cetriolo (cucumber)
Cepillo-Spazzola (brush)	Tarro-Barattolo (jar)
Zorro-Volpe (wolf)	Rayo-Fulmine (lightning)
Zapato-Scarpa (shoe)	Cangrejo-Granchio (crab)
Látigo-Frusta (whip)	Cerdo-Maiale (pig)
Tapadera-Coperchio (lid)	Bufanda-Sciarpa (scarf)
Galleta-Biscotto (cookie)	Mariquita-Coccinella (ladybug)
Alfombra-Tappeto (carpet)	Iglesia-Chiesa (church)
Tirita-Cerotto (bandaid)	Percha-Gruccia (hanger)
Cama-Letto (bed)	Bellota-Ghianda (acorn)
Almohada-Cuscino (pillow)	Oveja-Pecora (sheep)

Tuerca-Bullone (nut)	Mariposa-Farfalla (butterfly)
Different-gender condition	
Target	Distractor
Ventana-Finestra (window)	Corcho-Tappo (cork)
Vaca-Mucca (cow)	Cubo-Secchio (bucket)
Pata-Zampa (leg)	Tarro-Barattolo (jar)
Muñeca-Bambola (doll)	Cangrejo-Granchio (crab)
Caja-Scatola (box)	Pepino-Cetriolo (cucumber)
Jarra-Brocca (pitcher)	Cerdo-Maiale (pig)
Calabaza-Zucca (pumpkin)	Rayo-Fulmine (lightning)
Cazo-Mestolo (ladle)	Bufanda-Sciarpa (scarf)
Chaleco-Gilet (vest)	Oveja-Pecora (sheep)
Murciélago-Pipistrello (bat)	Iglesia-Chiesa (church)
Silbato-Fischio (whistle)	Mariquita-Coccinella (ladybug)
Loro-Pappagallo (parrot)	Bellota-Ghianda (acorn)
Lazo-Fiocco (bow)	Mariposa-Farfalla (butterfly)
Queso-Formaggio (cheese)	Percha-Gruccia (hanger)

Appendix E. Experiment 6.

Target picture nouns		Distractor word condition	
Nouns	Gen.	Gender congruent	Gender incongruent
Bed (cama)	f.	Church (iglesia)	Worm (gusano)
Table (mesa)	f.	Gun (pistola)	Mirror (espejo)
Lid (tapadera)	f.	Strawberry (fresa)	Duck (pato)
Boot (bota)	f.	Needle (aguja)	Eye (ojo)
Window (ventana)	f.	Flashlight (linterna)	Clown (payaso)
Leg (pierna)	f.	Rope (cuerda)	Ring (anillo)
Towel (toalla)	f.	Apple (manzana)	Parrot (loro)
Pigeon (paloma)	f.	Orange (naranja)	Knife (cuchillo)
Spoon (cuchara)	f.	Cherry (cereza)	Hat (sombrero)
Bell (campana)	f.	Moon (luna)	Screw (tornillo)
Carrot (zanahoria)	f.	Sheep (oveja)	Desk (escritorio)
Scarf (bufanda)	f.	Pumpkin (calabaza)	Horse (caballo)
Skirt (falda)	f.	Candle (vela)	Padlock (candado)
Suitcase (maleta)	f.	Crown (corona)	Rabbit (conejo)
Brush (cepillo)	m.	Worm (gusano)	Orange (naranja)
Monkey (mono)	m.	Padlock (candado)	Crown (corona)
Hammer (martillo)	m.	Rabbit (conejo)	Gun (pistola)
Shoe (zapato)	m.	Parrot (loro)	Needle (aguja)
Glass (vaso)	m.	Ring (anillo)	Moon (luna)
Balloon (globo)	m.	Eye (ojo)	Apple (manzana)
Pig (cerdo)	m.	Screw (tornillo)	Church (iglesia)
Fox (zorro)	m.	Mirror (espejo)	Pumpkin (calabaza)
Arm (brazo)	m.	Desk (escritorio)	Candle (vela)
Bear (oso)	m.	Clown (payaso)	Cherry (cereza)
Book (libro)	m.	Horse (caballo)	Strawberry (fresa)
Finger (dedo)	m.	Hat (sombrero)	Sheep (oveja)
Cheese (queso)	m.	Duck (pato)	Flashlight (linterna)
Dog (perro)	m.	Knife (cuchillo)	Rope (cuerda)

Appendix F. Experiment 7.

Experimental picture nouns (Spanish-Italian)	
Gender incongruent	Gender congruent
Almohada-Cuscino (pillow)	Bufanda-Sciarpa (scarf)
Cama-Letto (bed)	Falda-Gonna (skirt)
Mesa-Tavolo (table)	Mariposa-Farfalla (butterfly)
Mochila-Zaino (backpack)	Maleta-Valigia (suitcase)
Tapadera-Coperchio (lid)	Ventana-Finestra (window)
Seta-Fungo (mushroom)	Manzana-Mela (apple)
Tirita-Cerotto (band-aid)	Calabaza-Zucca (pumpkin)
Gaviota-Gabbiano (seagull)	Iglesia-Chiesa (church)
Bota-Stivale (boot)	Golondrina-Rondine (swallow)
Mantequilla-Burro (butter)	Abeja-Ape (bee)
Nariz-Naso (nose)	Sartén-Padella (pan)
Flor-Fiore (flower)	Nuez-Noce (walnut)
Cepillo-Spazzola (brush)	Grifo-Rubinetto (faucet)
Columpio-Altalena (swing)	Loro-Pappagallo (parrot)
Mono-Scimmia (monkey)	Taladro-Trapano (power drill)
Trineo-Slitta (sled)	Apio-Sedano (celery)
Zapato-Scarpa (shoe)	Cazo-Mestolo (ladle)
Cigarro-Sigaretta (cigarette)	Corcho-Tappo (cork)
Globo-Mongolfiera (hot air)	Sombrero-Cappello (hat)
Mosquito-Zanzara (mosquito)	Queso-Formaggio (cheese)
Zorro-Volpe (fox)	Perro-Cane (dog)
Tornillo-Vite (screw)	Vaso-Bicchiere (glass)
Coche-Macchina (car)	Tomate-Pomodoro (tomato)
Enchufe-Spina (plug)	Reloj-Orologio (clock)
Control picture nouns (Spanish-Italian)	
Gender incongruent	Gender congruent
Tenedor-Forchetta (fork)	Buitre-Avvoltoio (vulture)
Sobre-Busta (envelope)	Avestruz-Struzzo (ostrich)
Despertador-Sveglia (alarm clock)	Tiburón-Squalo (shark)
Rallador-Grattugia (grater)	Paraguas-Ombrello (umbrella)

Hombro-Spalla (shoulder)	Gusano-Verme (warm)
Látigo-Frusta (whip)	Taburete-Sgabello (stool)
Araña-Ragno (spider)	Zanahoria-Carota (carrot)
Ardilla-Scoiattolo (squirrel)	Jarra-Brocca (pitcher)
Cartera-Portafoglio (wallet)	Olla-Pentola (pot)
Galleta-Biscotto (cookie)	Pata-Zampa (leg)
Escopeta-Fucile (shotgun)	Carretera-Strada (road)
Bata-Camice (white coat)	Cereza-Ciliegia (cherry)

NOTES