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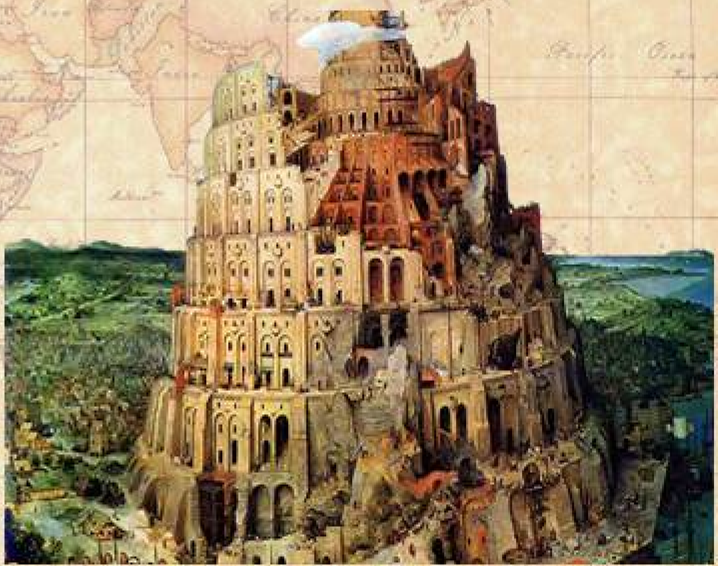
TESIS DOCTORAL

AUTOMATICITY AND COGNITIVE CONTROL IN BILINGUAL AND TRANSLATION EXPERTISE

DOCTORADO INTERNACIONAL

GIULIA TOGATO



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AUTOMATIZACIÓN Y CONTROL COGNITIVO EN LAS PRÁCTICAS BILINGÜE Y TRADUCTORA

Tesis Doctoral presentada por **Giulia Togato** en el *Departamento de Psicología Experimental*, para aspirar al grado de *Doctor en Psicología*, en el programa de doctorado de *Psicología Experimental y Neurociencias del Comportamiento*, de la Universidad de Granada.

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La doctoranda | Los directores de la tesis

Fdo. Giulia Togato | Fdo. Mª Teresa Bajo Molina | Fdo. Pedro Macizo Soria

A MI MADRE

A MI HERMANO

A MI PADRE
(In memoriam)

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CAPÍTULO I

INTRODUCCIÓN

PREFACIO

No hay duda de que, hoy en día, hablar al menos dos idiomas es la norma más que la excepción; ya en 1982, en su libro *Life with two languages*, Grosjean afirmaba que es casi imposible encontrar un país que se pueda considerar exclusivamente monolingüe, y en el que no existan una o varias minorías lingüísticas. Además, los recientes fenómenos de globalización y de libre circulación de los bienes y de las personas han conllevado una creciente inversión de recursos económicos en la actividad de la traducción y de la interpretación. No ha de sorprender, por lo tanto, que los temas del bilingüismo, de la traducción y de la interpretación sean objeto de estudio tanto en el ámbito de la psicología como en el de la traducción; contamos con una gran cantidad de literatura especializada que trata el tema del bilingüismo desde varios puntos de vista. Las investigaciones han utilizado una gran variedad de metodologías y paradigmas experimentales, y han adoptado enfoques teóricos a veces muy distintos, dando a entender que el campo de los fenómenos lingüísticos en bilingüismo es muy amplio, complejo y en continuo desarrollo. En 1994, Mike Dillinger apuntaba que no es suficiente hacer que los intérpretes y traductores investiguen, ya que suelen cometer errores básicos relativos al diseño experimental y al análisis estadístico, debido ello a que no están acostumbrados a este tipo de planteamiento; a la vez, tampoco es del todo suficiente hacer que los investigadores experimentales se aproximen al estudio de la traducción, porque suelen cometer errores ligados a la observación de la práctica traductora[1], ya que no poseen la experiencia suficiente en la tarea. La única solución razonable, apunta el autor, es cooperar en la investigación, ya que ninguno de los dos grupos posee la práctica necesaria en el dominio que pretende estudiar.

[1] *Nota de la escritora*: en el presente trabajo, los términos "traductor(a)" (en su uso como adjetivo y/o sustantivo) y "traducción" abarcarán tanto la actividad de traducción como de interpretación profesional. Cuando se considere necesario diferenciar las dos prácticas (traductora y de interpretación) se especificará mediante el uso de los términos "intérpretes" o "interpretación".

Por esta misma razón, como traductora interesada en el enfoque experimental, al acabar mis estudios de traducción me di cuenta de que carecía de los conocimientos y de las herramientas útiles para investigar de manera exacta sobre el entorno de la traducción desde un punto de vista cognitivo. Como todos los traductores, dediqué muchos años a la mejora del proceso de traducción en sí, es decir, a desarrollar habilidades que mejoraran la efectividad y la rapidez a la hora de ofrecer un servicio de traducción que cumpliera con las expectativas de los clientes. Sin embargo, desde siempre sentí interés hacia lo que supuestamente ocurría en la "caja negra"; conocía el entorno de mi trabajo, traducía mucho y a diario, interpretaba, revisaba textos en mi segundo idioma; sin embargo, todavía no sabía *cómo* todo esto ocurría, ya que mi experiencia personal siempre se había guiado por un proceso de aprendizaje ensayo-error. Cuando tuve la oportunidad de acercarme al mundo de la psicología y, más concretamente, al enfoque experimental en bilingüismo y traducción, obviamente, no la dejé escapar, y decidí, en cierto sentido, comenzar de cero. Empecé a darme cuenta de que sí hay formas efectivas y más exactas de entender qué pasa en la mente de un traductor y de que, más que de una caja negra, se trata de un sistema: la traducción humana no funciona como el *Google Translator*, los traductores no somos diccionarios ambulantes, ni "se nace" traductor; la traducción se entrena y cambia en función de la interacción del individuo con el entorno. De acuerdo, muchos dirán que lo importante, a fin de cuentas, es que el proceso garantice que la "entrada" se transforme en "salida"; de no ser así, no habría traducción. Sin embargo, la traducción no puede considerarse meramente como una alternancia de input y output. En la transformación, también ha de tenerse en cuenta *cómo* se realiza el proceso, y las relaciones entre el proceso y el entorno; la traducción es un sistema dentro de otros sistemas, es decir, la "suma total de partes que funcionan independientemente pero conjuntamente para lograr productos o resultados requeridos, basándose en las necesidades" (Kaufman, 1993). Sólo de esta forma, a) explorando el funcionamiento de los procesos cognitivos subyacentes a una ejecución efectiva de la tarea traductora, b) teniendo en cuenta el impacto de la conducta en el entorno y viceversa y c) adoptando un enfoque interdisciplinar (coherente con cuanto propone la *Teoría de Sistemas*, Bertalanffy, 1979) será posible hallar patrones de datos recurrentes y emplearlos para orientar los programas de entrenamiento en traducción hacia la mejora consistente y paulatina de la ejecución.

De ahí que, últimamente, se haya insistido tanto en la necesidad de orientar la investigación hacia ejes interdisciplinares, que puedan ofrecer una visión y análisis más completo de la interacción entre los sistemas y fenómenos sociolingüísticos y psicológicos ligados al aprendizaje de idiomas.

Por esta razón, en el caso del presente trabajo, intentaré establecer un puente entre las líneas de investigación psicológica y traductológica, con el objetivo de articular intuiciones procedentes del ámbito traductológico en un diseño experimental metodológicamente sólido desde el punto de vista experimental, explotando la idea según la cual la pericia en traducción ha de considerarse un caso específico de la pericia en general (Sirén y Hakkarainen, 2002).

En términos generales, me centraré en intentar responder a algunas de las preguntas que más interesan a los profesionales y a los monitores involucrados en la selección, entrenamiento y evaluación de traductores. ¿Es verdad que los traductores profesionales, en comparación con los bilingües no entrenados profesionalmente, manejan de forma distinta sus recursos lingüísticos y de regulación cognitiva debido a su continua práctica de dominio? ¿Hay habilidades que son específicas de los traductores y que los diferencian de los bilingües no entrenados? ¿De qué forma la facilidad con la que supuestamente manejan material lingüístico entre idiomas se refleja en el balance entre procesos de automatización de la práctica lingüística y control cognitivo sobre la tarea? Como apunta Dillinger (1994), las respuestas a estas preguntas son fundamentales, ya que pueden proporcionar los elementos sobre los que basar el desarrollo de estándares profesionales muy altos, programas de formación adecuada y, en general, la mejora de la práctica profesional.

En términos más concretos, por lo que concierne la estructura del apartado introductorio, partiré de la formulación del concepto de *Expertise* profesional (en adelante, *pericia* profesional), tomando en consideración a) las aportaciones teóricas al concepto por parte de los estudios realizados en resolución de problemas, b) su aplicación a la actividad traductora y la c) reelaboración experimental llevada a cabo en el ámbito psicolingüístico. A continuación se analizará la incorporación de los constructos de automatización y control cognitivo al concepto de pericia, retomando el recorrido por las perspectivas mencionadas. El objetivo de la primera parte de la introducción es la observación de la pericia como producto del balance entre automatización y control cognitivo en función del tipo de bilingüismo.

La segunda parte de la introducción se centra en el análisis de aquellas sub-habilidades lingüísticas que se han considerado imprescindibles para que la tarea traductora se desarrolle de forma rápida y eficaz, implicando el menor desgaste posible de recursos cognitivos. De hecho, cuando el procesamiento lingüístico requiere menor cantidad de recursos cognitivos, hay mayor capacidad para ejecutar procesos necesarios en la tarea traductora (e.g., monitorización de la simultaneidad de los procesos de comprensión y producción, tanto escrita como oral); en el caso de la traducción, una mayor cantidad de recursos disponibles implica el mantenimiento de la rapidez y la eficiencia a lo largo de todo el proceso de traducción (Christoffels, de Groot, y Waldorp, 2003). Las sub-habilidades que se consideran fundamentales a la hora de "ahorrar" recursos cognitivos en favor de la rapidez y de la eficiencia (calidad de la traducción) son, por un lado, a) la habilidad para modular la coactivación de la lengua fuente (LF) y de la lengua meta (LM), evitando errores de traducción y/o episodios de interferencia (Grosjean, 2013; MacWhinney, 2001; Ruiz, Paredes, Macizo, y Bajo, 2008); y, por el otro, b) la habilidad para recuperar equivalentes de traducción de forma rápida y eficaz (Christoffels, de Groot, y Kroll, 2006; Christoffels et al., 2003). Dado que la tarea traductora se desarrolla por fragmentos de discurso (Christoffels et al., 2006), ya que los profesionales difícilmente traducen o interpretan palabras sueltas (Christoffels et al., 2003), se analizará el papel de las dos sub-habilidades mencionadas a nivel de frase, con el objetivo de mantener una aproximación ecológica a la tarea real de traducción.

LA PERICIA EN TRADUCCIÓN: BALANCE ENTRE AUTOMATIZACIÓN Y CONTROL COGNITIVO

El concepto de pericia en resolución de problemas

Los estudios sobre pericia en resolución de problemas se han realizado desde numerosos enfoques, pivotando generalmente en torno a dos intuiciones fundamentales, pues la ejecución superior de una tarea se atribuye bien a características generales de los individuos, bien a aspectos específicos de los mismos. Estas dos posturas, «características generales» versus «habilidades específicas» también se han asociado a la distinción entre lo «heredado» y lo «adquirido». Galton (1869), por ejemplo, es sus estudios pioneros sobre el origen de las diferencias individuales, concluyó que la calidad en la ejecución de una tarea guardaba correlación directa con capacidades generales heredadas genéticamente.

Otros trabajos posteriores siguieron reflejando esta dualidad de enfoques en el estudio de la pericia; por un lado, muchos investigadores en el campo de la resolución de problemas intentaron identificar las habilidades y heurísticos de tipo general necesarios para resolver cualquier tipo de problemas (ver Mayer, 1983 para una revisión). Según esta perspectiva, los sujetos aplican heurísticos de naturaleza muy general a todo tipo de situación y los transfieren también a diversas áreas más específicas del conocimiento. La ejecución experta, desde este punto de vista, la mostrarían aquellas personas que poseen capacidad para utilizar heurísticos generales de resolución de problemas.

Los estudios que hablan de habilidades específicas, sin embargo, basándose en la comparación de expertos y novatos, no indican que las personas expertas en un área del conocimiento poseen almacenados en la memoria a largo plazo heurísticos de resolución de problemas diferentes de los novatos, sino más bien que el uso y la activación de determinados heurísticos ante distintos problemas es diferente y más eficaz en los expertos, porque poseen conocimientos específicos de dominio (Holyoak, 1991). Desde esta perspectiva la pericia está basada en la aplicación de conocimientos y habilidades específicas de dominio. Numerosos estudios, primero en el ajedrez (de Groot, 1965; Chase y Simon, 1973) y luego en el ámbito de la física (Chi, Feltovich, y Glaser 1981; Larkin, McDermott, Simon, y Simon, 1980) y sucesivamente en otros dominios, empezaron a mostrar que la pericia depende principalmente del conocimiento específico de dominio, reflejado en habilidades específicas y modelos inferenciales particulares. Por ejemplo, de Groot (1965), y Chase y Simon (1973) descubrieron que los jugadores expertos de ajedrez no difieren de otras personas en su inteligencia general ni en su capacidad de memoria sino en que, cuando están resolviendo una tarea de ajedrez, utilizan sus recursos de memoria de una manera mucho más eficaz. De Groot (1965) pedía a los sujetos que reprodujeran la posición de un número variable de piezas sobre un tablero, justo después de haber contemplado la configuración durante un intervalo de 2 a 10 segundos. Tras analizar los protocolos verbales de los sujetos, de Groot afirmó que los grandes maestros de ajedrez percibían y reorganizaban las características de los movimientos de juego y evaluaban posibles movimientos sucesivos apoyándose en su experiencia previa de juego, más que deteniéndose en calcular y planificar los movimientos posibles. Los resultados de de Groot, replicados por Chase y Simon (1973), mostraron que los jugadores expertos recordaban las configuraciones mucho mejor que los novatos, pero sólo cuando las posiciones de las fichas se podían alcanzar en juegos reales y no cuando eran aleatorias. De hecho, en el caso de esquemas de juegos no reales, el rendimiento de los expertos no era superior al de los novatos, demostrando que la pericia en una tarea depende de la presencia de relaciones significativas entre la tarea y su realización en contextos reales, ya que la experiencia y la pericia son fruto directo de vivencias reales. De forma similar, Ericsson (1996, 2003a, 2003b), y Kliegl, Smith, y Baltes (1989) demostraron que la utilización de estructuras de conocimiento específico estaban a la base del aumento de la capacidad de memoria con el entrenamiento (Chase y Ericsson, 1982) y de la superioridad del recuerdo de los expertos dentro de su dominio (ver Ericsson, 1996 para una revisión).

En consecuencia, la investigación más reciente pone el énfasis en la especificidad de algunas habilidades y estrategias de resolución de problemas. Ello permite hablar de pericia de dominio y, desde este planteamiento, de pericia en la práctica con idiomas (bilingüismo) y de pericia en traducción.

La pericia en bilingüismo y traducción

Segalowitz y Frenkiel-Fishman (2005), Segalowitz y Hulstijn (2009) apuntan que uno de los constructos psicológicos más útil para entender de qué manera la práctica lleva a la formación de expertos es la automatización. De Groot y Christoffels (2006) apuntan que el entrenamiento en tareas de traducción, que hace que la comprensión y los procesos de recuperación sean más rápidos y automáticos, juega un papel fundamental en el reparto de recursos cognitivos, ya que cuanto más automáticos sean comprensión y recuperación, más recursos disponibles habrá para evitar errores de traducción/ interferencia durante la fase de producción.

Sin embargo, hay otra característica que marca la diferencia entre expertos profesionales, novatos y bilingües: la capacidad para mantener altos niveles de control cognitivo durante el desarrollo de la tarea (Bajo, Padilla, y Padilla, 2000). La investigación de las diferencias entre aprendices con distintos grados de competencia ha puesto sucesiva y claramente de manifiesto la estrecha relación entre aprendizaje automático y control cognitivo (cf., por ejemplo, Pressley y McCormick, 1995; Schunk y Zimmerman, 2007).

La distinción entre procesos automáticos y controlado fue propuesta por varios investigadores (Kahneman, 1973; LaBerge y Samuels, 1974; Posner y Snyder, 1975; Schneider y Shiffrin, 1977; Shiffrin y Schneider, 1977) que notaron que las actividades de tipo cognitivo implican "esfuerzos atencionales" diferentes. Estos autores también mostraron que la práctica continua y prolongada a lo largo del tiempo permite que las operaciones cognitivas se ejecuten con menos esfuerzo, más rápidamente; mientras que otras conllevan generalmente tiempos más largos y consumen más recursos cognitivos. El primer tipo de actividades mentales ha sido clasificado como automático (Shiffrin, Dumais, y Schneider, 1981) y el segundo tipo ha sido denominado no-automático (Hunt, 1978), consciente (Posner y Snyder, 1975), controlado (Shiffrin et al., 1981) o se ha hablado de actividades que no requieren esfuerzo (Hasher y Zacks, 1979).

Se han realizado muchos estudios sobre control cognitivo analizando la conducta de novatos con distintos niveles de familiaridad con la tarea. La razón reside en que cuando el aprendiz se enfrenta con la resolución de una tarea nueva no dispone del conocimiento relevante para solventar el problema, y se ve obligado a buscar la solución (Mateos, 1999); para ello, entra en una fase de regulación deliberada y consciente (Brown y Vanlehn, 1980; Jansweijer, Elshout, y Bielinga, 1990). Este proceso de autorregulación de la conducta constituye una fuente importante de diferencias. Como menciona Ericsson (2006), los estudios tradicionales sobre adquisición de habilidades y pericias mostraron que la ejecución experta está en muchos casos asociada a la automatización y, por lo tanto, a la realización de las tareas propias del dominio sin esfuerzo y mediante la utilización de rutinas de recuperación de procedimientos almacenados en la memoria. Sin embargo, la evidencia también muestra que los expertos son capaces de ejercer mayor control sobre aquellos aspectos de las tareas donde el control es necesario o deseable (ver Chi, 2006 para una revisión de estos estudios). Por ejemplo, son numerosos los estudios que muestran que los estudiantes más competentes aplican estrategias de control cognitivo en mayor medida y con mayor efectividad que los malos estudiantes (Chi, 2006; Chi, Bassok, Lewis, Reimann, y Glaser, 1989). Los estudiantes menos competentes, por su parte, detectan menos problemas de comprensión y elaboran menos el contenido del material de estudio (Chi et al., 1989; Pirolli y Recaer, 1994); cuando se enfrentan a un problema tienden a actuar de forma inmediata y asistemática, sin supervisar su actuación (Jansweijer, Elshout, y Bielinga, 1990; Lawson y Chinnapan, 1994; Shoenfeld, 1983, 1987). Shoenfeld (1983) describe la actuación de un matemático que consiguió resolver un problema para él no rutinario, gracias a la supervisión y regulación constantes que ejerció sobre su propia actuación. Este control no se observó en estudiantes novatos, que no llegaron a encontrar la solución. Esto implica que el experto posee una capacidad de autorregulación de la que carece el novato, pues el primero está acostumbrado al proceso de solución de problemas. Desde esta perspectiva, por tanto, la adquisición de la pericia en un dominio conlleva la automatización de algunos aspectos de la tarea y el control de otros aspectos (Chi, 2006; Ericsson, 2006); consecuencia de ello es que tanto el dominio de un idioma como la adquisición de la pericia en traducción pueden implicar automatización y control. Lo que determinará la condición de novato vs. experto, a raíz de los estudios disponibles sobre el tema, será la fluctuación en el balance entre procesos automáticos y controlados de resolución de problemas.

Segalowitz (Segalowitz, 1991; Favreau y Segalowitz, 1983; Segalowitz y Frenkiel-Fishman, 2005) fue uno de los pioneros en utilizar el constructo psicológico de la automatización para estudiar la práctica con idiomas: el autor apunta que un tipo de aprendizaje basado en la repetición de rutinas y en la organización de la experiencia lingüística en representaciones mentales subyacentes sólo puede estudiarse en función de su adquisición automática. Segalowitz, Segalowitz, y Wood (1998) acuñaron la expresión *cognitive fluency* para referirse a los procesos subyacentes a la ejecución experta de una tarea. Esta fluidez cognitiva refleja, apunta el autor, la eficiencia con la que los procesos responsables de una habilidad se ejecutan en su conjunto, es decir, la naturaleza del balance entre lo automático y lo controlado. Una de las consecuencias inmediatas de la práctica sería, según los autores, un desplazamiento de los procesos controlados hacia los automáticos, sin caer, no obstante, en la rigidez extrema de procesos demasiado mecánicos e inflexibles.

En ámbito psicolingüístico, el constructo fue aplicado a la observación de múltiples fenómenos; Segalowitz y Frenkiel-Fishman (2005) apuntan que la aplicación de la idea de automatización fue particularmente productiva en la observación de: a) la ejecución experta en una segunda lengua, b) la relación entre automatismos y procesos controlados en la adquisición de L2.

a) En cuanto a los estudios sobre la ejecución experta en L2, una demostración de la importancia de la automatización ha sido proporcionada por Favreau y Segalowitz (1983). Los autores compararon dos grupos de lectores relativamente expertos en L2: el primer grupo, formado por “bilingües balanceados”, se caracterizaba por la capacidad de leer textos en L1 y L2 a la misma velocidad, alcanzando el mismo nivel de comprensión en ambas lenguas. El segundo grupo, de “bilingües no balanceados” estaba formado por participantes que, para alcanzar el mismo nivel de comprensión en ambas lenguas, tenían que leer más lentamente en L2 que en L1. El objetivo del estudio era averiguar si los bilingües más expertos poseían habilidades de reconocimiento de palabras descontextualizadas más automatizadas en comparación con los bilingües más débiles. Los autores utilizaron un paradigma de priming en una una tarea de decisión léxica en la que los participantes veían un prime y un target. El prime podía ser un sustantivo perteneciente a una determinada categoría (por ejemplo, la palabra FRUIT) o una secuencia de símbolos sin sentido. El prime señalaba la aparición de un target, que podía ser un sustantivo perteneciente a la categoría indicada por el prime (por ejemplo, APPLE), un ejemplar perteneciente a otra categoría distinta (por ejemplo, TABLE), o una no-palabra. La tarea consistía en decidir si el target era una palabra o no-palabra (decisión léxica). En algunas condiciones, entrenó a los participantes de manera que automatizaran la presencia de un target no relacionado semánticamente con el prime (p.e. FRUIT-TABLE). Favreau y Segalowitz (1983), al igual que Neely (1977), Tweedy, Lapinsky y Schvaneveldt (1977) encontraron que el entrenamiento era responsable de efectos de facilitación e inhibición adecuados en L2. Por ejemplo, en presencia de un intervalo temporal largo (1.150 milisegundos) y después del entrenamiento entre primes y targets no-relacionados (e.g., FRUIT-TABLE), la presentación de un prime como FRUIT facilitaba la decisión léxica hacia el target entrenado (TABLE), pero producía un efecto inhibitorio en los ensayo no esperados pero semánticamente relacionado con el prime, como APPLE. Por el contrario, cuando el intervalo entre el prime y el target era corto (200 milisegundos) la decisión léxica en los ensayos no esperados (APPLE) presentaba efectos de facilitación, indicando que el sujeto era incapaz de inhibir la activación de conceptos semánticamente relacionados con el prime FRUIT (APPLE, ORANGE, BANANA, etc.). Esto pasaba a pesar de que las instrucciones y el entrenamiento indicaran que el prime no predecía esos targets. En este sentido, el experimento demostró la naturaleza automática del proceso de reconocimiento semántico de palabras. Favreau y Segalowitz (1983) observaron que en L2 sólo el grupo de bilingües balanceados poseía este tipo de automatización. La investigación de estos autores demostró que el procesamiento semántico de algunas personas bilingües -más expertas- funciona de manera más automática.

b) Segalowitz y Frenkiel-Fishman (2005) apuntan que, además del papel jugado por la automatización en el aprendizaje de idiomas, hay que tener en cuenta la importancia de otro aspecto, no-automático y de naturaleza atencional, que es fundamental para la adquisición fluida de una lengua. Este segundo aspecto atencional incluye la capacidad de dirección consciente de la atención hacia el lenguaje en la fase de aprendizaje y la reflexión sobre las destrezas que pueden ser necesarias para lograr un uso efectivo del idioma. Los autores afirman que la atención selectiva es una parte fundamental de la pericia en la práctica lingüística, ya que refleja la capacidad de los sujetos de centrarse en el proceso de comunicación. Para estudiar el papel de los procesos controlados en el aprendizaje de un segundo idioma, Segalowitz y Frenkiel-Fishman (2005) crearon una tarea de cambio atencional a partir de un estudio de Rogers y Monsell (1995). Los autores partieron del supuesto que la pericia en

L2 está estrechamente ligada al nivel de control que el bilingüe ejerce sobre las funciones de direccionamiento atencional propias del lenguaje. El control atencional se definió en términos de la capacidad de una persona para mover el foco atencional de un aspecto a otro de una lengua. Los autores asumieron que el control atencional es un proceso subyacente al procesamiento bilingüe de la L2, y se detuvieron en la observación de la correlación entre 1) el nivel de bilingüismo y 2) la habilidad de cambio (*switch*) atencional, por parte de los sujetos, entre las dos distintas funciones atencionales representadas por adverbios y conjunciones, respectivamente. Los autores partieron de la hipótesis que un mejor control sobre los aspectos relevantes de una lengua se vería reflejado en la habilidad de ejecutar los cambios rápidamente, ya que los cambios atencionales están a la base del uso de una lengua.

El nivel de bilingüismo de los participantes fue determinado mediante una tarea de categorización léxica, desarrollada en ambos idiomas. En cuanto a la tarea atencional, las variables dependientes medidas fueron tiempo de reacción y porcentaje de aciertos. Los autores utilizaron como estímulos adverbios temporales y conjunciones, partículas caracterizadas por un marcada función deíctica, es decir, por la posibilidad de dirigir la atención del interlocutor. Los adverbios, de hecho, están relacionados con una perspectiva de fondo/primer plano temporal (antes, después, pronto, tarde, etc.) mientras que las conjunciones permiten al interlocutor establecer un orden/link discursivo (porque, a pesar de, dado que, etc.). En la tarea relativa a los adverbios, se les pedía a los participantes que ubicaran temporalmente el adverbio, definiendo su distancia temporal con respecto al momento presente; la segunda tarea consistía en determinar la presencia (o ausencia) de una relación causal entre las oraciones conectadas por la conjunción, como por ejemplo en "Juan aprobó el examen porque estudió toda la noche" y "Juan aprobó el examen a pesar de no haber estudiado en todo el año". Las dos tareas se realizaron tanto en L1 como en L2. Los adverbios temporales (T) y las conjunciones (C) se presentaron en el siguiente orden: "…TTCCTTCCTTCC…", causando la secuencia "repetición (R)-cambio (C)": "…RCRCRCRCRCRC…".

En la mayoría de los estudios que emplean el paradigma de alternancia entre ensayos de repetición y de cambio se aprecian tiempos de reacción más rápidos en el caso de la repetición, a pesar de que el sujeto sea consciente de la presencia de un punto de cambio y disponga de tiempo para prepararse; es decir, los sujetos se ven afectados por cierto coste debido al cambio del foco atencional. Los autores pudieron apreciar una correlación importante entre los costes atencionales procedentes de la tarea de cambio y el nivel de bilingüismo de los participantes (medido en función de su rapidez y precisión en tareas de acceso léxico), demostrando que el control cognitivo de los recursos atencionales juega un papel determinante en la adquisición de pericia en la práctica con idiomas y en los procesos de acceso léxico y semántico. Estos datos son consistentes con los resultados de Bajo, Padilla, y Padilla (2000) que, comparando bilingües no-entrenados vs. traductores profesionales, observaron una ventaja cuantitativa en traductores tanto en tiempos de lectura de textos complejos como en aciertos a la hora de recordar los textos, y con las investigaciones de Bialystok (2001) sobre la superioridad de algunos procesos atencionales en los bilingües.

Como en toda habilidad de dominio, resulta difícil separar los procesos de control cognitivo de los automáticos, ya que el ser expertos en control cognitivo implica un equilibrio entre automatización de procesos ya practicados -con el fin de mantener la eficiencia- y flexibilidad a la hora de producir respuestas no practicadas. Este balance, sin lugar a dudas, se ve modulado por la experiencia en cuanto al reparto de recursos cognitivos, con el fin de desarrollar la tarea (en nuestro caso, traductora) de forma eficaz (Ericsson, 2006).

Lo que aún no parece del todo claro es dónde se ubica el punto de inflexión que discrimina entre la conducta novata y experta en el balance que une los dos elementos (automatismo y control ejecutivo): posiblemente a medida que el bilingüe desarrolla mayor control cognitivo, sus destrezas de dominio mejoran y se automatizan como consecuencia de ello; otra posibilidad es que la automatización en los procesos de acceso léxico y semántico permita un mejor reparto de los recursos cognitivos disponibles y, por consiguiente, una mejora general en la capacidad de control atencional.

Hasta donde llega nuestro conocimiento, no hay estudios psicolingüísticos que se detengan en observar el balance entre automatización y control cognitivo en función del entrenamiento en tareas de traducción. Así pues, la idea clave del presente trabajo es que la pericia en la traducción profesional puede modular dicho balance, y, por consiguiente, el balance podría variar en función de distintas experiencias en bilingüismo, tanto en tareas lingüísticas como no lingüísticas. Nuestro objetivo, en el trabajo de investigación que presentamos, es explorar el equilibrio entre automatismo y control cognitivo en bilingües y traductores expertos desde la perspectiva psicolingüística.

Control cognitivo y bilingüismo

Hasta las experiencias más superficiales pueden influir en el funcionamiento de los procesos cognitivos básicos; podemos reconocer un objeto porque previamente tuvimos la experiencia con ese objeto, y porque, además, la recordamos. Así que actividades y formas de entrenamiento específico moldean la manera en que los individuos ejecutan los procesos cognitivos subyacentes, produciendo cambios estructurales y funcionales en el cerebro que se reflejan en una mejora del control cognitivo global. El impacto del bilingüismo en la cognición, es decir, en la manera de procesar la información procedente del entorno, está claramente comprobado en ámbito psicolingüístico. Green y Abutalebi (2013) sugieren que el manejo de dos o más idiomas incrementa las demandas cognitivas asociadas al procesamiento lingüístico, reforzando el control lingüístico por parte de los bilingües, lo que conduciría a una mejora del control ejecutivo global responsable del desarrollo de tareas no verbales que requieren de control cognitivo.

Según algunos autores, el uso de más de una lengua se asociaría a una mejora del control cognitivo general (lingüístico y no lingüístico) debido a que las habilidades de naturaleza no verbal requieren de la puesta en marcha de los mismos procesos de control necesarios para el control lingüístico (Green y Abutalebi, 2013). De hecho, el control lingüístico presenta desafíos importantes para los hablantes, ya que las acciones comunicativas son muy poco predecibles en cuanto a su planificación y ejecución, se ven influenciadas por el contexto comunicativo y las intenciones de los hablantes, de forma que desde el punto de vista del control cognitivo, el uso del lenguaje es especialmente demandante.

Las investigaciones empíricas de los últimos 20 años parecieron confirmar un mejor control cognitivo asociado al bilingüismo (e.g., Bialystok, 2007, 2009). Sin embargo, los beneficios asociados al manejo de varias lenguas han de ser tomados con precaución, ya que hay estudios que no lograron replicar los resultados obtenidos en la mayoría de las investigaciones sobre el tema. Por ejemplo, Paap y Greenberg (2013) no lograron detectar la ventaja bilingüe a pesar de emplear varias tareas conductuales. Otros estudios han hallado diferencias entre poblaciones jóvenes y de edad más avanzada (e.g., Gold, Kim, Johnson, Kryscio, y Smith, 2013) diferencias debidas al uso contextual de la L2 (e.g., Linck, Kroll, y Sunderman, 2009), y también hay estudios que detectan la ventaja bilingüe sólo en tareas especialmente demandantes (e.g., Costa, Hernández, Costa-Faidella, y Sebastián-Gallés, 2009). Por esta razón, a la hora de determinar las posibles mejoras cognitivas asociadas al bilingüismo, han de ser considerados diferentes factores como, por ejemplo, el tipo de bilingüismo y la manera en que la persona bilingüe maneja sus lenguas a la hora de desarrollar la tarea (Green, 1998, 2011; Green y Abutalebi, 2013).

Como indicamos, una amplia variedad de estudios sugirieron un mejor control cognitivo asociado al bilingüismo. Por ejemplo, se ha observado que los niños bilingües destacan en la ejecución de la tarea Simon si los comparamos con los monolingües. En la tarea Simon (Morton y Harper, 2007), se les presentan a los participantes unos rectángulos de colores (por ejemplo, rojos y verdes), de forma congruente o incongruente en cuanto a la asociación espacial del color con la tecla de respuesta. Por ejemplo, los rectángulos rojos se asocian con la tecla derecha mientras que los verdes con la tecla izquierda. Un ensayo congruente consistiría en la presentación del rectángulo rojo en la derecha (respuesta asignada inicialmente), mientras que en un ensayo incongruente el rectángulo rojo aparecería en el lado contrario (izquierdo). Baker, Kovelman, Bialystok, y Petitto, (2003) y Bialystok (2006) observaron que aunque las respuestas a los ensayos incongruentes se caracterizan, por lo general, por un mayor número de errores y tiempos de reacción más lentos, los niños bilingües ejecutan mejor la tarea. Patrones similares de resultados se observan para otras tareas, como para el Test de clasificación de cartas con cambio de dimensión (Zelazo, Reznick, y Pinon, 1995), tareas de clasificación (Bialystok, 1999; Bialystok y Martin, 2004, Experimento 1), para la tarea de conservación de Piaget (Bialystok y Majumder, 1998), tareas que implican la rotación mental de imágenes (Bialystok y Shapero, 2005) y la resolución de problemas (Bialystok y Senman, 2004).

Por ejemplo, en la tarea de clasificación de cartas con cambio de dimensión, Bialystok y colaboradores (Bialystok, 1999; Bialystok y Martin, 2004) les pidieron a niños de 4 y 5 años que clasificaran unas cartas en función del color o de la forma del dibujo en ellas impreso. El efecto crítico residía en la facilidad de cambio al pasar de un tipo de clasificación a otra, ya que los niños suelen mantener la clasificación inicial. Los niños bilingües mostraron menos resistencia al cambio, y siguieron las instrucciones de cambio de tarea, lo que implica niveles más altos de control cognitivo (Bialistok y Craik, 2010).

La eficiencia en los procesos de control cognitivo asociados al bilingüismo, así pues, aparece en edad temprana (antes de que el niño pueda hablar) y sigue persistiendo durante la edad adulta y la madurez. Por ejemplo, en condiciones de cambio de tarea, los adultos, al igual que los niños, presentan menores costes cognitivos al realizar cambios de tarea, tanto en tareas lingüísticas como no-lingüísticas (Prior y Gollan, 2011). Este dato se ha replicado en numerosos estudios y mediante varios paradigmas experimentales. Por ejemplo, en la tarea Stroop (Bialystok, Craik, y Luk, 2008; Hernández, Costa, Fuentes, Vivas, y Sebastián-Gallés, 2010) y de Flancos (Costa, Hernández, y Sebastian-Gallés, 2008), los bilingües son capaces de responder mejor en condiciones de conflicto, ignorando información irrelevante que compite con la respuesta acertada. Lo que tienen en común estas tareas es que proporcionan un índice de control inhibitorio, es decir, de la habilidad de inhibir la información irrelevante para producir la respuesta relevante y que mejor se ajuste al objetivo de la tarea.

Por otro lado, también se ha observado mayor eficiencia, por parte de los bilingües, en procesos básicos de memoria y atención. Luo, Craik, Moreno y Bialystok (2013) compararon adultos monolingües y bilingües empleando una tarea de amplitud de memoria de trabajo. Los bilingües ejecutaron la tarea de memoria de trabajo espacial mejor que los monolingües, confirmando la presencia de un mejor control ejecutivo en bilingües. Costa et al. (2008) emplearon la tarea de redes atencionales (tarea ANT, desarrollada por Fan, McCandliss, Sommer, Raz, y Posner, 2002), para comparar bilingües y monolingües en alerta atencional, orientación y control ejecutivo. Los bilingües destacaron en alerta y control ejecutivo, confirmando una ejecución eficiente en el ámbito lingüístico que se generaliza también al ámbito atencional.

El buen funcionamiento de las personas bilingües en control cognitivo es más fácilmente observado en tareas especialmente difíciles. Por ejemplo, Bialystok (2006) observó que, durante la ejecución de la tarea Simon, los bilingües destacaban en condiciones experimentales que implicaban mayor monitorización y cambio de tarea, y no en condiciones más simples. Este patrón de resultados se confirmó en un estudio de Costa et al. (2009) en que se empleó una tarea de Flancos manipulando la carga de monitorización de la tarea; se crearon una condición de baja (Experimento 1) vs. alta monitorización (Experimento 2), jugando con distintos patrones de presentación de los ensayos congruentes e incongruentes. Los autores observaron que las diferencias entre bilingües y monolingües se manifestaban sólo en condiciones de alta monitorización. Los datos sugieren que el bilingüismo afecta a los procesos de monitorización implicados en el control ejecutivo y que los bilingües son más eficientes a la hora de monitorizar el sistema cognitivo para resolver el conflicto.

En cuanto a las personas mayores, se ha documentado un menor declive en control atencional, lo que sugiere que el bilingüismo actúa incrementando la reserva cognitiva y protegiendo del envejecimiento cognitivo (ver Craik y Bialystok, 2006, para una revisión). Bialystok, Craik, y Freedman (2007) analizaron el historial médico de pacientes monolingües y bilingües afectados por demencia. Se observó que los pacientes bilingües empezaron a desarrollar los síntomas aproximadamente 4 años más tarde que los monolingües. Más concretamente, los monolingües fueron diagnosticados a la edad de 75.4 años mientras que los bilingües desarrollaron la demencia a partir de los 78.6 años. Los datos se confirmaron también en pacientes que padecían Alzheimer (Craik, Bialystok, y Freedman, 2010).

En consecuencia, el conjunto de estudios revisados en este apartado parece sugerir que el bilingüismo redunda en un mejor control cognitivo, tanto en tareas lingüísticas como no lingüísticas. Sin embargo, las últimas investigaciones y perspectivas teóricas al respecto sugieren que dichas mejoras son matizables. De hecho, se ha demostrado que el que aparezca o no la ventaja bilingüe y el tipo de procesos en que aparece esta ventaja dependen del tipo de bilingüe considerado y de la tarea que se utiliza para captar la ventaja (Abutalebi y Green, 2013; Morales, Gómez-Ariza, y Bajo, 2013; Morales, Padilla, Gómez-Ariza, y Bajo, 2015). Así pues, han de ser considerados diferentes factores y experiencias en bilingüismo a la hora de concretar la forma en que el uso de dos lenguas modula los procesos de control cognitivo. Green (2011) apunta que las comunidades bilingües difieren, ya que algunas de ellas mezclan los idiomas de habla (*code-switching*) mientras que otras no. Los hablantes que pertenecen a comunidades en las que no se suelen mezclar los idiomas son expertos en la evitación del conflicto lingüístico. Por otro lado, en comunidades que alternan los dos idiomas, el control lingüístico funciona de forma distinta (Green, 1998), ya que sus hablantes se benefician de la activación conjunta de sus idiomas. Su habilidad depende menos de la evitación del conflicto lingüístico y más de la adaptación de la respuesta a la activación dual de sus idiomas de habla. Green y Abutalebi (2013) han demostrado que la Corteza Cingulada Anterior (CCA), la Corteza Frontal Izquierda y el Núcleo Caudado responden de manera distinta a la activación de un único idioma vs. dos o más idiomas. En un contexto de doble activación (*code switching*), en el que por ejemplo se les pide a los participantes que nombren objetos en los dos idiomas, se activan las tres regiones (e.g., Abutalebi, Annoni, Zimine, Pegna, Seghier, Lee-Jahnke, Lazeyras, Cappa, y Khateb, 2008). Llama la atención el hecho de que este patrón de actividad cerebral esté ausente cuando los participantes han de nombrar objetos en la L1, contexto en el que no se requiere cambio de idioma. Además, la respuesta del Núcleo Caudado es especialmente sensible al cambio de idioma, ya que no se observa respuesta alguna cuando el contexto no requiere cambio (Kovelman et al., 2008; Rodriguez-Fornells, Rotte, Heinze, Nösselt, y Münte, 2002). Así pues, parece que la ecología bilingüe de las personas moldea los circuitos neuronales implicados en el control lingüístico, ya que la presencia o ausencia de alternancia/ mezcla lingüística conlleva distintas demandas cognitivas en términos de control (Green, 2011). Respuestas distintas por parte de los circuitos de control a distintos contextos lingüísticos se explican en función de la selección temprana y tardía, basándose en la idea de que, puesto que haya activación conjunta de ambos idiomas, los hablantes bilingües tendrán que resolver el conflicto inhibiendo el idioma no requerido en algún momento (Green, 1986, 1998; Hoshino y Thierry, 2011; Linck, Kroll, y Sunderman, 2009; Macizo, Bajo, y Martín, 2010; Philipp y Koch, 2009) o limitando la competición léxica en la lengua de llegada de alguna forma (e.g., Costa y Caramazza, 1999; Elston-Güttler, Gunter, y Kotz, 2005; Finkbeiner y Caramazza, 2006, ver Bialystok, Craik, Green, y Gollan, 2009, para una revisión).

Green (2011) sugiere que en un contexto de activación de un solo idioma, las entradas léxicas del idioma que no está en uso se bloquean de forma temprana, gracias a la actividad de la Corteza Frontal Inferior. Por consiguiente, otras estructuras -como el Núcleo Caudado- no se activan. En cambio, en contextos de doble activación, los ensayos de cambio requieren necesariamente una selección tardía y, en este contexto, sí se observa activación del Núcleo Caudado. La respuesta del circuito es similar a la que demuestran los individuos cuando responden a los ensayos incongruentes en la tarea Stroop (Green, 2011). En este caso, los participantes han de inhibir la respuesta incorrecta procedente de una palabra escrita. La supresión de la interferencia activa el Caudado y regiones frontales (Ali, Green, Kherif, Devlin, y Price, 2010).

En resumen, el bilingüismo no es una variable categorica (Luk y Bialystok, 2013) ya que implica la interacción de factores como la fluidez lingüística y el uso en el entorno del lenguaje (Bialystok y Hakuta, 1994; Fishman y Cooper, 1969; Hakuta, Bialystok, y Wiley, 2003). La experiencia bilingüe es dinámica y hay bastantes factores que ejercen influencia sobre la ventaja bilingüe. Por ejemplo, Luk y Bialystok (2013) examinaron las respuestas a un cuestionario proporcionadas por 110 bilingües heterogéneos; se analizaron el uso lingüístico, el historial adquisitivo y la auto-evaluación de la fluidez., El uso bilingüe diario y la fluidez objetiva en inglés correlacionaron. Además, estos dos factores también correlacionaron con las puntuaciones en auto-evaluación de la competencia lingüística en inglés y en el otro idioma. Las autoras concluyeron que la experiencia bilingüe se compone de varias dimensiones interrelacionadas, que han de tomarse en consideración a la hora de evaluar la consecuencias del bilingüismo, ya que los estudios indican que cada una de las experiencias bilingües que los hablantes experimentan a diario influencia de forma única el funcionamiento de los mecanismos de control cognitivo. Esta idea desempeña un papel crucial en el desarrollo del presente trabajo.

Control cognitivo y experiencia en traducción

Si asumimos la idea actual de que el bilingüismo no es un concepto unitario sino el producto emergente de una variedad de experiencias bilingües, son necesarios estudios en que se evalúen las diferencias entre bilingües con y sin experiencia traductora en procesos generales de control cognitivo.

Yudes, Macizo, y Bajo (2011b), por ejemplo, hipotetizaron que quizás traductores y bilingües mostrarían mejoras en componentes diferentes de las funciones ejecutivas. Compararon traductores profesionales y bilingües no entrenados en tareas de flexibilidad cognitiva (Test de clasificación de cartas de Wisconsin). El test de Clasificación de cartas de Wisconsin es una tarea que requiere, por parte de los participantes, que se infiera una norma de categorización de cartas. La norma se modifica a lo largo de la tarea, así que los participantes han de inferir la nueva norma constantemente. Se proporciona *feedback* sobre si la respuesta es correcta o no, pero no se les informa sobre la norma. En otras palabras, la tarea refleja la habilidad de los participantes para cambiar de set cognitivo y adaptarse de manera flexible a la nueva norma. Los intérpretes del estudio de Yudes et al. (2011b) ejecutaron mejor la tarea de Clasificación de cartas de Wisconsin, ya que fueron más eficientes: fueron necesarios menos intentos para inferir la norma y cometieron un menor número de errores. Sobre todo, cometieron menos errores de perseveración, es decir, mostraron mayor flexibilidad cognitiva a la hora de cambiar las hipótesis ligadas a la inferencia de la norma. Ya que los participantes (monolingües, bilingües e intérpretes) fueron equiparados en memoria de trabajo, se pudo descartar que las diferencias en flexibilidad cognitiva se debieran a diferencias en amplitud de memoria, confirmando la hipótesis de la influencia de la pericia traductora. En consecuencia, los resultados de este estudio sugieren una mayor flexibilidad cognitiva de los traductores profesionales frente a otros grupos de individuos sin experiencia profesional en traducción.

Un estudio muy reciente de Morales et al. (2015) confirma que la pericia en interpretación simultánea se transfiere a otros dominios, y que esa transferencia parece ligada a los procesos cognitivos que se desencadenan durante la tarea traductora (MT, alerta y orientación de las redes atencionales). Sus datos son coherentes con las observaciones desarrolladas por Green y Abutalebi (2013; *The Adaptive Control Hypothesis*) en el ámbito del bilingüismo natural, que postulan que el uso de procesos ejecutivos de forma recurrente para negociar la activación de los dos idiomas del bilingüe y la selección del idioma relevante modifica el funcionamiento de los mecanismos computacionales demandados por la tarea.

Morales et al. (2015), al comparar traductores y bilingües no entrenados, observaron una mejor ejecución, por parte de los traductores, en cuanto a la actualización y monitorización de la información en la MT, empleando una tarea n-back con carga de memoria creciente. Los traductores mostraron mejor mantenimiento de los estándares de ejecución al incrementarse la carga de memoria, como consecuencia, posiblemente, de los procesos de actualización y monitorización implicados en la tarea traductora. Además, en términos atencionales, observaron ventaja cognitiva en cuanto a la alerta y orientación atencional, empleando una tarea ANTI-V; estos datos se amoldan a las principales características intrínsecas de la tarea traductora que, desde el punto de vista atencional, requiere justamente alerta para procesar el input y orientación a la hora de re-direccionar, de forma flexible, el foco de atención hacia la fase de producción (Cowan, 2000; Yudes et al., 2011b).

Estos resultados, una vez más, parecen confirmar que las habilidades que entran en juego en la práctica profesional de la traducción difieren de las que entran en juego en el bilingüismo, y que las consecuencias de este distinto despliegue de habilidades se manifiestan en un manejo distinto de los procesos cognitivos básicos. En la misma línea, en un estudio realizado con PET, Price, Green y Von Studniz (1999) midieron la activación cerebral de la Corteza Cingulada Anterior, una región fuertemente ligada al control cognitivo general (e.g., Dehaene, Posner, y Tucker, 1994; Ridderinkhof, Ullsperger, Crone, y Nieuwenhuis, 2004), durante la traducción, la lectura y el cambio entre la L1 y la L2. Observaron que esta región sólo se activaba durante el proceso de traducción, confirmando que este tipo de práctica implica, incluso a nivel neuronal, patrones de activación especiales.

En su conjunto, los estudios mencionados demuestran claramente que distintas experiencias en bilingüismo y un entrenamiento específico en tareas traductoras modulan el funcionamiento de los mecanismos de control cognitivo general que se necesitan para funcionar de forma eficaz bien como bilingüe o bien como traductor/ intérprete.

LA PERICIA EN TRADUCCIÓN DENTRO DEL MARCO DE LAS DIFERENTES EXPERIENCIAS BILINGÜES

En el apartado anterior hemos mostrado que el bilingüismo no ha de ser considerado como un concepto unitario sino que una serie de factores pueden modular el perfil cognitivo de las personas que manejan más de una lengua. De este modo, la traducción y la pericia en traducción han de ser consideradas en relación a otras formas de bilingüismo. A continuación se ofrece primero un recorrido por la perspectiva traductológica, y luego una revisión del enfoque psicolingüístico.

Perspectiva traductológica: Traducción natural vs. Traducción profesional

Hasta que la psicología comienza a investigar el concepto de Expertise, los estudios sobre las habilidades necesarias para ser traductor se concentran en modelos teóricos de competencia. Shreve (2002) afirma: "Nuestro interés en la pericia en traducción es una extensión de nuestra investigación sobre la competencia traductora" y define la competencia como lo que una persona tiene que aprender y saber para llegar a ser traductor (conocimientos declarativos), mientras que la pericia es, según el autor, la habilidad en el manejo de los mecanismos que utilizan los sujetos expertos en el proceso de solución de problemas, resultado de mejoras graduales mediante la práctica deliberada. Shreve (2002) añade que la acumulación de conocimientos declarativos (la competencia traductora) proporciona una base para el desarrollo experto en traducción, pero no es suficiente para perfilar lo que un traductor hace a diario: “Translation graduates may exhibit varying levels of translation competence, but not translation expertise” (Shreve 2002). Muñoz (2006) adopta en España, como traducción del término Expertise, la forma Pericia, y contribuye a la formulación de ese concepto, nuevo en el ámbito de la Traducción. El autor opina que la diferencia fundamental entre ambos enfoques es que mientras el concepto de competencia no dice nada sobre el modo en que los sujetos utilizan sus conocimientos, las pruebas realizadas a sujetos que disponen de pericia apuntan no sólo a la cantidad y a la calidad de los conocimientos almacenados, sino también al modo en que se almacenan y recuperan y a la forma en la que se usan.

Una discusión importante para determinar qué constituye la pericia en el ámbito de la traducción es la diferencia entre el dominio de una lengua y el dominio de las técnicas de traducción. En un principio, tanto en el ámbito psicolingüístico como traductológico, muchos investigadores mantienen que la pericia en traducción es una consecuencia inmediata y natural del bilingüismo. Este planteamiento no sólo implica que no hay diferencias entre traductores profesionales y bilingües, sino que tampoco las hay entre novatos y expertos en el ámbito de la traducción, ya que la pericia dependería exclusivamente del nivel de bilingüismo.

Harris (1973, 1977) y Harris y Sherwood (1978) señalan la existencia de una habilidad de traducción natural que tiene cualquier hablante bilingüe por la que es capaz de traducir en situaciones cotidianas sin haber experimentado un entrenamiento específico. Según Harris (1977), la competencia en traducción se solapa y se une con la traducción natural pues los bilingües, además de una competencia intralingüística en dos idiomas, poseen una competencia interlingüística en traducción directa e inversa desarrollada con el objetivo de transmitir la información para que la comunicación funcione bien. Para corroborarlo, Harris y Sherwood (1978), analizaron investigaciones estadounidenses sobre sujetos bilingües de varias edades y concluyeron que la habilidad de traducción es innata, que aparece en edad temprana y que evoluciona desde un estadio que denominaron pretraducción hasta un estadio que denominan semiprofesional (18 años). En el frente de la traductología, muchos investigadores matizan la hipótesis de traducción natural de Harris y Sherwood (1978): Toury (1979) y Presas (2000), por ejemplo, afirman que la competencia bilingüe no tiende necesariamente a crear la competencia traductora. Para Toury (1978), la competencia traductora no se desarrolla de forma automática y paralela al bilingüismo natural. El traductor debe crear una segunda competencia, de transferencia, que implica estructuras de conocimiento que no forman parte del bilingüismo. Presas (2000) opone la noción de traductor natural a la de traductor formado, afirmando que la habilidad de traducción natural no es suficiente para llegar a ser un traductor experto. También Muñoz (2006a) afirma que la capacidad de traducir no implica el éxito de un sujeto en la tarea, ni siquiera si es bilingüe. El autor apunta que cualquiera puede traducir, incluso bien, algo sencillo, pero para traducir un texto que goce de aceptación general entre destinatarios ajenos hace falta un aprendizaje específico que los lleve a modificar su comportamiento para alcanzar las cotas de calidad exigidas, y que implican conocimientos superiores sobre lenguas, usos, normas y equivalencias convencionales pero también, por ejemplo, rapidez, productividad y destreza en el uso de herramientas particulares.

Shreve (1997) considera que la competencia traductora es un continuo entre la traducción natural y la traducción construida (la traducción profesional) y especifica que el progreso no es automático y no es lineal, es decir, no hay un camino establecido; la competencia traductora es el producto del historial personal de adquisición del sujeto. Este planteamiento implica que, como señala Muñoz (2006), "como el desarrollo es paulatino, se puede avanzar la hipótesis de estadios intermedios, de un modo similar al de la interlengua de los aprendices de idiomas".

El punto débil de la investigación en traductología, y que no ha permitido dilucidar entre estas distintas posturas, es sin duda la falta de un marco empírico que pueda permitir operativizar las hipótesis avanzadas sobre el funcionamiento de la pericia en la práctica traductora. A pesar de ello, existen algunos estudios de carácter psicolingüístico que han intentado abordar esta cuestión.

Perspectiva psicolingüística: diferenciar subcomponentes y procesos cognitivos

Dillinger (1994), uno de los pioneros en el estudio comparativo de bilingües e intérpretes en el ámbito experimental, en un estudio psicolingüístico sobre comprensión en el proceso de interpretación apuntó que las diferencias entre la ejecución bilingüe y profesional residen en un mejor manejo general de los recursos cognitivos.

Sin embargo, tras esta perspectiva inicial, un gran número de investigaciones han intentado determinar en qué componentes y procesos cognitivos podrían establecerse diferencias según la experiencia profesional en traducción. De hecho, la traducción entre lenguas podría considerarse una situación extrema en que se ponen en juego multitud de procesos de control lingüístico (acceso léxico, semántico, procesamiento sintáctico), cognitivo general (Yudes et al., 2011a, b), memoria de trabajo (Signorelli, Haarmann, y Obler, 2011), atención dividida (Gile, 1995, 1997; MacWhinney, 2005), coordinación para pasar de un idioma al otro (Gile, 1991, 1997; Lambert, 1995; Danks, 1997; Christoffels y de Groot, 2004), y un eficiente reparto de los recursos atencionales entre las diferentes fases del proceso de traducción (Gile, 1995, 1997).

De esta manera, en las investigaciones realizadas dentro de las ciencias cognitivas, se han intentado desgranar qué procesos y componentes establecen las diferencias asociadas al entrenamiento en traducción frente a otras formas de bilingüismo.

Procesos de comprensión

Dillinger (1994) se detuvo en la observación del proceso de comprensión, analizando varios sub-componentes del proceso: el procesamiento sintáctico, la formulación sintáctica, el procesamiento microtextual (de frases independientes) y macrotextual (de frases con sentido incrustado en una entidad textual mayor, como un párrafo o apartado). Comparó un grupo de intérpretes profesionales, con una práctica de 3830 horas de trabajo y un grupo de bilingües de inglés y francés que nunca tuvieron contacto con la práctica de la interpretación, midiendo su ejecución en función del porcentaje de aciertos. En la tarea se utilizaron dos textos en inglés grabados en una cinta, simulando la práctica en cabina y pidiendo a los participantes que los interpretaran hacia el francés. En términos generales, Dillinger (1994) observó que el grupo de intérpretes profesionales se caracterizaba por diferencias cuantitativamente significativas en la producción de interpretaciones correctas, en el sentido de que los intérpretes fueron capaces de interpretar correctamente el 17% más del texto en comparación con los bilingües. Sin embargo, Dillinger no constató diferencias cualitativas en la ejecución de los dos grupos: la calidad del procesamiento sintáctico, de la formulación sintáctica y del procesamiento micro y macro textual fue igual en los dos grupos, sugiriendo que ambos analizaban los textos de la misma manera, y que las diferencias se debían a una mayor capacidad de selección, por parte de los intérpretes, de la cantidad de información procesada semánticamente, demostrando una mayor flexibilidad en los procesos de comprensión. Según el autor, la falta de diferencias cualitativas en los procesos de comprensión de bilingües e intérpretes sería la prueba de que la habilidad de interpretar sólo se debe a habilidades de tipo lingüístico, dependientes del nivel de bilingüismo; los intérpretes sólo se caracterizarían por una mayor flexibilidad en el manejo de recursos comunes a ambos grupos, flexibilidad que el autor considera como la causa de las diferencias cuantitativas entre los dos grupos.

Sin embargo, cuando se consideran de manera aislada y sistemática diferentes subcomponentes asociados a la comprensión lingüística, sí se observan diferencias entre traductores profesionales y bilingües sin formación en esta profesión.

Bajo, Padilla, y Padilla (2000), por ejemplo, realizaron un estudio basado en tareas de comprensión en el que compararon la ejecución de intérpretes profesionales, sujetos bilingües, estudiantes de interpretación y profesionales procedentes de otros dominios. Las autoras evaluaron de manera sistemática los procesos de comprensión de cada pieza léxica contenida en frases presentadas mediante la técnica de ventana móvil (los participantes pulsaban la barra espaciadora cada vez que leían un segmento de la frase y deseaban leer otro). Los resultados no mostraron diferencias significativas entre los grupos en cuanto a la precisión al comprender las oraciones, pero sí se apreciaron diferencias debidas al tiempo de lectura. Por tanto, a pesar de que bilingües y traductores pueden alcanzar igual comprensión de frases, el procesamiento parece ser más eficiente en el caso de los traductores profesionales.

Bajo et al. (2000), en su investigación, extendieron la observación de las diferencias entre práctica bilingüe y práctica profesional al ámbito del acceso léxico y semántico, utilizando una tarea de decisión léxica y de categorización, respectivamente. En la tarea de decisión léxica se les pidió a los sujetos que contestaran lo más rápidamente posible a la presencia de una palabra o no-palabra, presionando una tecla. En la tarea de categorización se presentaba a los sujetos una palabra y luego un sustantivo que designaba una categoría semántica: la tarea consistía en decidir si el concepto designado por la palabra pertenecía a la categoría semántica indicada. En la tarea de decisión léxica se observaron diferencias entre los varios grupos en cuanto a tiempos de reacción relativos al reconocimiento de las no-palabras, y los intérpretes destacaron en la rapidez de su acceso léxico, sobre todo en comparación con los bilingües. En la tarea de categorización se pudo apreciar el mismo patrón: se observó que los intérpretes destacaban en el reconocimiento de las relaciones semánticas no-típicas, respondiendo más rápidamente en comparación con los otros grupos, demostrando que acceden más rápidamente a la información semántica. Así pues, en tareas de comprensión, por ejemplo, al recuperar el significado de las palabras de una oración, los traductores profesionales parecen ser más eficientes que los bilingües sin formación específica en esta profesión.

Llegados a este punto podríamos preguntarnos cuál es el motivo de las diferencias observadas entre traductores profesionales y bilingües en tareas de comprensión. A continuación describimos diferentes líneas de estudio. Para anticipar, las diferencias entre traductores y bilingües sin entrenamiento parecen residir en (a) procesos lingüísticos específicos (e.g., acceso léxico, recuperación semántica, etc.), (b) la capacidad de los traductores para procesar en paralelo material de tipo lingüístico (es decir en condiciones de atención dividida), (c) la capacidad para coordinar entre diferentes subcomponentes de la tarea de traducción entre lenguas, (d) la capacidad de monitorizar la buena ejecución de los procesos lingüísticos que realizan.

Memoria de Trabajo y Atención dividida

En numerosos estudios se ha constatado que los traductores profesionales tienen una mayor amplitud de memoria de trabajo que las personas bilingües sin entrenamiento específico en traducción (e.g., Bajo et al., 2000; Christoffels et al., 2006). Además, se ha observado que la amplitud de memoria de trabajo se relaciona con la eficiencia de los traductores en tareas lingüísticas. Christoffels y de Groot (2003) administraron a bilingües sin experiencia previa en traducción profesional una tarea de Interpretación simultánea (IS) y, además, midieron la recuperación léxica mediante una tarea de traducción de palabras y una de nombrado de dibujo; la amplitud de memoria de trabajo se midió a través de una tarea de amplitud lectora y una tarea de amplitud de dígitos. Las autoras esperaban que las cuatro medidas correlacionaran con la ejecución en la tarea de interpretación. Se les pidió a los participantes que tradujeran oralmente un texto conforme lo fueran escuchando. Se observó una correlación muy alta entre la amplitud de la MT, la recuperación de equivalentes de traducción y la ejecución en IS. Estos datos implican que el uso eficiente de la MT y de los procesos de recuperación de equivalentes de traducción son las habilidades más importantes en IS.

De igual manera Christoffels et al. (2006) compararon intérpretes profesionales, estudiantes bilingües y profesores de inglés en tareas lingüísticas (traducción de palabras y nombrado de dibujos) y de memoria (tarea de amplitud de palabras y de lectura). De nuevo, los intérpretes fueron mejores que los bilingües en recuperación léxica y memoria de trabajo.

En otras investigaciones se ha estudiado de manera sistemática estas relaciones encontradas entre tareas lingüísticas y la memoria de trabajo. Bajo et al. (2000), por ejemplo, hallaron una mayor capacidad, por parte de los intérpretes, de mantener altos niveles de atención dividida, es decir, de control cognitivo durante la ejecución de tareas lingüísticas. Las autoras realizaron una tarea de memoria en la que les pidieron a los participantes que memorizaran una lista de palabras para, en un segundo momento, recordarla. A la vez, se introdujo una tarea de supresión articulatoria, de manera que todos los sujetos llevaron a cabo la tarea de memoria emparejada, en un 50% de las veces, con la de supresión articulatoria. La interacción entre el factor Grupo x Supresión articulatoria fue significativa, y los intérpretes destacaron en la ejecución de la tarea en presencia de supresión articulatoria (es decir, los traductores no mostraban efecto de supresión articulatoria durante la memorización de información). Así pues, la ejecución superior por parte de los intérpretes en tareas de comprensión, acceso léxico y semántico podría ser debida a un mejor control general de los recursos cognitivos.

Padilla, Bajo, y Macizo (2005) replicaron la ausencia de supresión articulatoria en intérpretes profesiones en comparación con un grupo control, ambos equiparados en su amplitud de memoria de trabajo. De este modo, la ausencia del efecto en los profesionales en los intérpretes no se debe sólo a su mayor amplitud de memoria de trabajo en sí mismo. De hecho, los autores apuntan que la destreza, por parte de los profesionales, a la hora de procesar y a la vez recuperar información mientras articulan el mensaje procesado previamente, podría deberse a la habilidad de repartir los recursos cognitivos de forma eficaz y coordinar entre diferentes subprocesos que suceden en paralelo. En un segundo experimento, Padilla et al. (2005) introdujeron una condición de doble tarea, más precisamente, de seguimiento visual. No se encontraron diferencias entre-grupos, lo que llevó a pensar que la ausencia de efecto de supresión articulatoria en intérpretes no se debe a la habilidad general de mantener la atención dividida entre varias tareas o procesos, sino a algún tipo de habilidad más cercana a los procesos de comprensión y producción simultánea, como acceso léxico o semántico a contenidos conocidos. Esta hipótesis fue corroborada por los autores en un último experimento en que se manipuló la familiaridad del material lingüístico empleado, prediciendo que, en condiciones de supresión articulatoria, se observaría el efecto en el caso de procesamiento de material no familiar (no-palabras). Este fue precisamente el resultado observado: la baja familiaridad del material implicó la aparición del efecto de supresión articulatoria, confirmando que la familiaridad con el material lingüístico es determinante para el funcionamiento del bucle fonológico y la modulación de la actividad de la MT en intérpretes profesionales.

Por tanto, los resultados anteriores sugieren, tal y como afirma Gile (1995, 1997), que un mejor manejo de la coactivación de la LF y la LM en traductores profesionales podría ser consecuencia de la habilidad de dividir la atención entre los componentes lingüísticos de la tarea traductora: procesamiento del input, recuperación del output y articulación del output relativo al mensaje previamente procesado. La buena coordinación de diferentes subprocesos lingüísticos parece subyacer la correcta ejecución de los traductores en tareas de traducción.

Coordinación de subprocesos lingüísticos

Estudios recientes han mostrado que los traductores profesionales, a diferencia de los bilingües, coordinan de manera eficiente los diferentes subprocesos asociados a la tarea de traducción como la comprensión de la lengua fuente a la par que la activación de formas léxicas en la lengua meta.

Macizo y Bajo (2006, Experimento 2) les pidieron a sus participantes que tradujeran oralmente unas frases presentadas visualmente. Las frases se presentaban en español para su traducción al inglés. Se manipuló el estado cognaticio de algunas palabras clave (e.g., piano). Las predicciones fueron que si los participantes accedían a las formas léxicas y semánticas de la LM antes de terminar el proceso de comprensión de la LF, se observaría facilitación en la lectura para los cognados, comparados con las palabras de control. Los resultados confirmaron la predicción inicial. Los tiempos de lectura para los cognados fueron más rápidos que para los controles. Además, el efecto de facilitación para los cognados sólo se dio cuando los profesionales leían para traducir; no se halló el efecto en el caso de leer para repetir, lo que implica que el procesamiento léxico se ve modulado por la tarea a desarrollar. Ruiz et al. (2008, Experimento 1) obtuvieron los mismos datos empleando el mismo procedimiento. En este estudio, se manipuló la frecuencia de las palabras críticas en la LM. En la lectura para traducir, las palabras con alta frecuencia de uso en la LM se procesaron más rápido que las palabras de baja frecuencia, a pesar de que todas las palabras estuvieran equiparadas en frecuencia en la LF. Una vez más, el efecto se observó en lectura para traducir y no en lectura para repetición.

Así pues, cuando los traductores profesionales realizan tareas de traducción (frente a otras tareas lingüísticas que requieren el uso de una lengua sola), coordinan la comprensión de la lengua fuente con la recuperación de formas léxicas de la lengua meta. Ahora bien, podríamos preguntarnos sobre las posibles diferencias en la manera de coordinar estos procesos dependiendo de la experiencia profesional en traducción.

Ibáñez, Macizo, y Bajo (2010) pidieron a bilingües y traductores profesionales (equiparados en nivel de L2) que leyeran frases en español o inglés; las frases se presentaban palabra por palabra y los participantes decidían durante cuánto tiempo mantener en pantalla la visualización de cada palabra. El idioma de presentación de las frases variaba de un ensayo a otro de una forma no predecible. Esta fue la primera manipulación crítica, ya que permitió observar la inhibición del idioma no empleado a través de la medición del coste de cambio al pasar de un idioma a otro en función de la dirección de la traducción (L1 hacia L2 o L2 hacia L1). Los autores también manipularon el estado cognaticio de algunas palabras. Los cognados entre idiomas son palabras parecidas tanto en su forma lingüística como en contenido semántico (e.g., *piano*, en inglés y español). Este tipo de manipulación (cognados vs. no cognados) es crítica, ya que se ha empleado como índice de la coactivación de los dos idiomas del bilingüe (Dijkstra, Grainger, y van Heuven, 1999; Kroll y Stewart, 1994; Macizo y Bajo, 2006). Se observó una ventaja de procesamiento en el caso de cognados para los traductores profesionales, indicando que éstos mantienen ambos idiomas activos durante el proceso de lectura. Además, los traductores no mostraron inhibición, ya que no presentaron coste asimétrico de cambio al pasar de un idioma al otro. En el caso de los bilingües, sin embargo, se observó un mayor coste de cambio hacia la L1 que hacia la L2, lo que implica que los bilingües sí inhiben el idioma innecesario durante la tarea. Además, en cuanto al procesamiento de los cognados en bilingües, no se observó facilitación, lo que sugiere que sólo el idioma en uso estaba activo. En otras palabras, distintas experiencias en bilingüismo fueron la causa de distintos patrones de activación de los dos idiomas y de diferencias en los mecanismos de control lingüístico: los traductores mantenían las dos lenguas activas y no mostraban efectos de coste al cambiar de una lengua a otra, mientras que los bilingües sólo mantenían activo el idioma de presentación y, por consiguiente, se producía un coste en la comprensión cada vez que se cambiaba de idioma. Estos resultados indican que existen diferencias en la forma en que traductores y bilingües coordinan los diferentes procesos implicados en la tarea de traducción.

Monitorización de los procesos lingüísticos

Finalmente, queríamos destacar un estudio reciente en que parece demostrarse que los traductores profesionales tienen desarrolladas habilidades metalinguisticas y de control cognitivo que aplican eficientemente en las tareas de comprensión del lenguaje.

Yudes et al. (2011a) compararon monolingües vs. grupos de bilingües con distintas experiencias en bilingüismo (bilingües no entrenados, estudiantes de traducción y traductores profesionales) en comprensión de textos. Al mismo tiempo que se realizaba la tarea de comprensión, las personas debían detectar errores léxicos, sintácticos y semánticos en textos en inglés durante el proceso de lectura. Los intérpretes detectaron más errores sintácticos y semánticos comparados con los otros grupos; también mostraron mejor comprensión de los textos en general. Así pues, este estudio pionero sugiere que los intérpretes tienen un buen desarrollo de habilidades metalingüísticas (conocimiento sobre la manera de realizar el proceso de comprensión) y monitorización (chequeo de la corrección de las formas léxicas, sintácticas) durante la lectura y comprensión del lenguaje.

Diferentes experiencias en bilingüismo: La edad de adquisición de la L2

Tal y como indicamos en el apartado anterior, la tendencia actual es considerar al bilingüismo no como un concepto unitario sino como una categoría que engloba gran cantidad de experiencias en el manejo de más de una lengua (Green, 2001; Luk y Bialystok, 2013). En consecuencia, sería relevante considerar qué papel juega la edad de adquisición de una segunda lengua en la arquitectura cognitiva de las personas bilingües.

Por otro lado, también comentamos al inicio de este apartado que, desde el punto de vista traductológico, algunos autores defienden que la pericia en traducción viene de la mano de un buen manejo de la L2, lo cual sería más probable en el caso de un aprendizaje temprano de una segunda lengua (i.e., DeKeyser, 2000; Johnson y Newport, 1989). En nuestra sección empírica directamente evaluaremos las posibles diferencias entre bilingües tempranos frente a bilingües tardíos durante la realización de tareas lingüísticas. Pero antes de ello, consideramos necesario revisar investigaciones previas sobre el papel de la edad de adquisición de la L2.

Se ha demostrado ampliamente que uno de los predictores más robustos y fiables de la actividad neuronal y de la conducta subyacente al uso de la L2 es la Edad de Adquisición (EdA) (para una revisión, Birdsong, 2005). La EdA influencia la actividad neuronal en procesos fonéticos (Frenck-Mestre, Anton, Roth, Vaid, y Viallet, 2005), en tareas de evaluación de la gramaticalidad Hernandez, Kotz, y Hofmann, 2007; Waldron y Hernandez, 2013; Wartenburger, Heekeren, Abutalebi, Cappa, Villringer, y Perani, 2003), en acceso léxico (Mahendra, Plante, Magloire, Milman, y Trouard, 2003; Perani, Abutalebi, Paulesu, Brambati, Scifo, Cappa, y Fazio, 2003) y en procesamiento sintáctico (Mahendra et al., 2003). Los estudios más recientes emplean Resonancia Magnética Funcional para analizar el impacto de la EdA en la actividad neuronal. Por ejemplo, Wartenburger et al. (2003) compararon bilingües tempranos vs. tardíos en una tarea de evaluación de la gramaticalidad sintáctica en la L2. Los participantes fueron equiparados en nivel de la L2; los autores manipularon la gramaticalidad de las frases, empleando frases correctas, frases con violaciones semánticas y sintácticas. Demostraron, por parte del grupo de bilingües tardíos, la presencia de mayor activación cerebral en el área de Broca, pero sólo en presencia de violaciones de tipo sintáctico. Estos datos fueron interpretados como prueba del impacto de la EdA en el procesamiento sintáctico en bilingües.

Hernandez, Hoffman, y Kotz (2007) compararon bilingües tempranos y tardíos en procesamiento de formas sintácticas irregulares. Los participantes evaluaron la concordancia entre los sustantivos incluidos en la frase. Los dos grupos mostraron diferencias en los patrones de activación: al procesar formas sintácticas irregulares, se observó en el grupo tardío un aumento de la actividad neuronal en las áreas 44 y 45 de Broadmann. Se demostró, de esta forma, que las estructuras sintácticas aprendidas en épocas tardías de la vida necesitan de un procesamiento adicional. Saur, Baumgaertner, Moehring, Büchel, Bonnesen, Rose, y Meisel (2009) hipotetizaron que la influencia de la EdA sería más visible en frases en la L2 cuyo orden canónico es infrecuente en la L1 (frases verbo-sujeto vs. sujeto-verbo). Compararon bilingües tempranos vs. tardíos de francés-alemán, equiparados en nivel de idiomas. Pidieron a los participantes que indicaran, presionando una tecla, si la frase presentada era correcta o incorrecta. Al procesar las frases en su L2, los bilingües tardíos mostraron mayor activación comparados con los tempranos, en áreas cerebrales asociadas con el procesamiento sintáctico (giro frontal inferior izquierdo y medio, pars triangularis –BA 44-, giro temporal inferior izquierdo y ganglios basales). Este estudio confirmó el impacto de la EdA en el procesamiento sintáctico. Wei, Joshi, Zhang, Mei, Manis, He, Lu, et al. (2015) aplicaron técnicas de medición morfométrica a áreas cerebrales específicas; observaron que la volumetría cerebral era sensible a la EdA; cuanto más temprana la EdA, mayor el volumen del giro angulado derecho y del lóbulo parietal superior derecho. También observaron que cuanto más tardía la EdA, mayor el volumen de giro frontal inferior derecho. En otras palabras, todos estos estudios de corte neurocientífico confirman que la EdA es uno de los factores que más impacto tiene sobre la organización neuronal.

Por otro lado, como ya mencionamos en el apartado anterior, manejar dos idiomas implica la mejora de mecanismos generales de control cognitivo que no son específicos del lenguaje (Abutalebi y Green, 2007; Green, 1998; Kroll, 2008; van Heuven, Schriefers, Dijkstra, y Hagoort, 2008). La práctica hace que los mecanismos lingüísticos se generalicen a otros dominios del funcionamiento cognitivo (Bialystok, Craik, Green, y Gollan, 2009; Festman, Rodriguez-Fornells, y Münte, 2010; Ye y Zhou, 2009). La mayoría de los estudios que han detectado un mejor funcionamiento en personas bilingües se basan en el análisis de la conducta de participantes que aprendieron sus dos idiomas en edad muy temprana (Tao, Marzecová, Taft, Asanowicz, y Wodniecka, 2011); recientemente, se ha planteado que distintas EdA pueden causar diferencias en el uso de funciones ejecutivas (Luk, De Sa, y Bialystok, 2011). Tao et al. (2011) compararon bilingües tempranos vs. tardíos en la tarea LANT (*Lateralized Attention Network Test*), que proporciona un índice de la eficiencia de la red de alerta atencional. Plantearon que si la práctica en monitorización y cambio entre idiomas desde una edad temprana es fundamental para la mejora atencional, entonces no debería de observarse una mejor ejecución en bilingües tardíos. Los autores observaron que la EdA es crucial para que se detecte la mejor ejecución en monitorización, ya que TRs más rápidos sólo se observaron en el grupo de bilingües tempranos. En otras palabras, parece que la EdA juega un papel fundamental en la mejora de los procesos de monitorización.

Luk et al. (2011) compararon monolingües, bilingües tempranos y tardíos en la tarea de Flancos, una tarea de control cognitivo. El efecto de la EdA correlacionó positivamente con el efecto de Flancos. El efecto fue menor en el caso de los bilingües tempranos, ya que éste grupo se demostró más eficiente a la hora de suprimir información conflictiva y más fuerte en el mantenimiento del control cognitivo sobre la tarea.

En la base de los estudios citados, es posible apuntar que la EdA es uno de los factores que más influencian tanto la organización neuronal como la conducta lingüística bilingüe. Esta idea justifica ampliamente el interés del presente estudio, en el que se comparan bilingües tempranos y tardíos en cuanto a su reparto de recursos cognitivos tanto en tareas lingüísticas como no-lingüísticas.

DISPONIBILIDAD DE RECURSOS COGNITIVOS Y AUTOMATIZACIÓN EN TAREAS LINGUISTICAS

Modulación de la coactivación de la lengua fuente y de la lengua meta

Desde un punto de vista cognitivo, la actividad traductora implica al menos tres procesos básicos: (a) comprensión de la lengua fuente (LF) (análisis de las unidades léxicas, procesamiento sintáctico y semántico); (b) cambio de idioma y/o reformulación al pasar de un idioma a otro; (c) producción en la lengua meta (LM) (e.g., Gerver 1976; Lambert 1992; Padilla et al., 1995). El interés fundamental de los estudios sobre traducción e interpretación ha sido entender de qué forma estos tres mecanismos interactúan y sobre qué base temporal. Antes de intentar entender de qué forma distintas experiencias en bilingüismo modulan el reparto de recursos cognitivos a la hora de procesar material lingüístico para la traducción, es indispensable analizar de qué manera los profesionales gestionan uno de los problemas más grandes a la hora de traducir: la interferencia debida a la coactivación entre idiomas. Los profesionales, de hecho, se entrenan para evitar la transferencia de características de la LF a la LM cuando éstas no son pertinentes en el idioma de llegada, lo que produciría interferencia entre idiomas.

La mayoría de los estudios demuestran que los intérpretes acceden al léxico y a la semántica de la LM antes de que haya finalizado el procesamiento de la LF. En otras palabras, durante la tarea traductora, ambos idiomas se mantendrían activos (e.g., Macizo y Bajo, 2006; Ruiz et al., 2008; Ibáñez et al., 2010) a pesar de que sólo uno de ellos esté en uso. Esa doble activación de posibles candidatos para producir una respuesta implica la selección de una alternativa, tanto en comprensión como en producción. La doble activación también se ha observado en bilingües no entrenados en traducción (Blumenfeld y Marian, 2007; Colomé, 2001; Dijkstra, 2005; Hoshino y Thierry, 2011; Ju y Luce, 2004; Kroll y Stewart, 1994; Macizo, Bajo, y Martín, 2010; Spivey y Marian, 1999).

En nuestra opinión, la coactivación entre lenguas sería la principal causa del mejor control cognitivo observado en personas bilingues y traductores frente a personas monolingües (discusión revisada en el apartado "Coordinación de sub-procesos lingüísticos"): las demandas cognitivas impuestas por el bilingüismo y la traducción son mucho mayores comparadas con las que actúan sobre los monolingües, y desencadenan procesos de control que permiten que la conducta se mantenga en línea con los objetivos comunicativos impuestos por el contexto de interacción (Botvinick, Cohen, y Carter, 2004).

Por el otro lado, se ha demostrado que bilingües y traductores se enfrentan de forma distinta a la coactivación lingüística (Ibáñez et al., 2010); los bilingües inhiben el idioma que no está en uso (Ibáñez et al., 2010; Bialystok, 2001), mientras que los traductores no emplean mecanismos de inhibición, sino que mantienen activos ambos idiomas para llevar a cabo la tarea traductora (Grosjean, 2008; Ibáñez et al., 2010; Macizo y Bajo 2006;). La literatura disponible confirma que, en cuanto a procesamiento léxico se refiere, los intérpretes son capaces de mantener ambos idiomas simultáneamente activos al desarrollar la tarea traductora (acceden a los equivalentes de traducción de la LM antes de completar el proceso de comprensión en la LF). Además, también han de mantener los idiomas separados, ya que la interferencia entre idiomas se considera, en el mercado de la traducción, síntoma de baja calidad del servicio; así pues, los profesionales han de ser capaces de recibir la LF y entregar la LM sólo (Grosjean, 1997). Sin embargo, cabe destacar que los componentes de input tanto de la LF como de la LM han de estar activados, ya que el acceso léxico y semántico a las propiedades de la LF se recuperan durante la lectura/escucha de la LF.

Si nos centramos en los procesos lingüísticos intrínsecamente ligados a la comprensión de frases (análisis sintáctico), uno de los estudios más relevantes sobre el tema es el de Ruiz et al. (2008, Experimento 2). En este estudio se pretendió investigar si las personas bilingües captaban reglas sintácticas (e.g., orden sintáctico habitual de un nombre y un adjetivo modificado), durante tareas de traducción. Se les pidió a un grupo de traductores que leyeran frases en español para repetirlas en el mismo idioma o traducirlas al inglés. Los autores manipularon la congruencia cross-lingüística del orden de las palabras en la frase. En frases congruentes, el adjetivo se presentaba antes del sustantivo y el sujeto siempre precedía el verbo de la subordinada relativa (e.g., *la bonita casa que yo alquilé este verano tenía un verde jardín*). La estructura en castellano es congruente con la estructura que se emplea en inglés, ya que en inglés los adjetivos siempre anteceden al sustantivo y el sujeto suele acompañar al verbo, e.g., *The nice house that I rent this summer had a green garden*). En cambio, en frases incongruentes, se violaba la relación típica adjetivo-sustantivo y sujeto-verbo en la LF; e.g., *la casa bonita que alquilé este verano tenía un jardín verde*).

Los resultados del estudio revelaron que, a la hora de leer para traducir, los participantes leyeron más rápido las frases congruentes que las incongruentes; es decir, comprendieron más rápidamente la información para traducirla posteriormente cuando había congruencia sintáctica entre los dos idiomas implicados en el proceso de traducción; sin embargo, no se observaron diferencias en función de la congruencia entre idiomas en la tarea de lectura para repetir. El mismo patrón de resultados se observó en el caso de la traducción desde la L2 (inglés) hacia la L1 (español). Las frases con estructura sintáctica congruente se leyeron más rápido que las incongruentes, sugiriendo que los profesionales activan las estructuras sintácticas de la LF durante la lectura orientada a la traducción (Paredes, 2011).

De esta forma, parece ser que los traductores profesionales coactivan sus lenguas. En concreto, el efecto de facilitación encontrado entre idiomas en el procesamiento sintáctico confirma que ambos idiomas se activan simultáneamente durante la tarea, aunque los intérpretes sean capaces de mantenerlos independientes (de hecho, evitan la interferencia). El efecto de facilitación también confirma que recuperan la estructura sintáctica de la LM para la fase de producción antes de haber completado el proceso de comprensión en la LF, de forma que logran emplear los mecanismos de input y output simultáneamente pero de forma independiente, modulando su nivel de activación incluso a nivel sintáctico (Grosjean, 1997; 2001; 2013)

Uno de los propósitos del presente trabajo es entender el funcionamiento de los mecanismos de input y output de la LF y LM que subyacen al procesamiento sintáctico para la traducción; nos centramos en observar diferencias en procesamiento debidas a la congruencia entre idiomas y cómo esta congruencia influye en el manejo de la coactivación de las lenguas implicadas en el proceso de traducción en función del tipo de bilingüismo. Para ello, empezamos por la observación de la resolución de ambigüedades sintácticas por parte de los profesionales (cuando la tarea implica un cambio de la modalidad monolingüe a la bilingüe) y seguimos manipulando la congruencia entre idiomas a nivel de frase a través de estructuras co-ocurrentes entre idiomas (e.g., formas idiomáticas o *idioms*), intentando hallar diferencias entre poblaciones con distintas experiencias en bilingüismo.

El procesamiento de frases ambiguas en bilingües y el manejo de la coactivación entre idiomas

La observación de cómo los profesionales solucionan las ambigüedad sintáctica durante la tarea de traducción permite observar de qué forma los procesos subyacentes tanto a la LF como la LM se reclutan a la hora de desarrollar la tarea. Se ha demostrado que la manera de comprender oraciones de relativo ambiguas es específica de cada idioma (Carreiras 1992; Carreiras y Clifton 1999; Gilboy, Sopena, Clifton, y Fraizer 1995). En frases como *Someone shot the servant of the actress who was on the balcony*, hay dos antecedentes, "servant" y "actress", y los dos son agentes potenciales de la oración relativa "was on the balcony". Los nativos de habla inglesa resuelven la ambigüedad adoptando una estrategia de adjunción baja, en línea con el principio de cierre tardío propuesto por la Teoría del *Garden Path* de Frazier (Frazier 1978; Frazier y Rayner 1982).

Según esta estrategia, los nuevos elementos (la oración relativa) están ligados a la frase nominal que está procesándose, la más reciente (*the actress*). Sin embargo, la literatura ha demostrado de forma consistente la existencia de diferencias cross-lingüísticas en la adjunción de la cláusula de relativo (Carreiras y Clifton 1999; Gilboy et al., 1995), mediante el uso de diferentes métodos experimentales, como la evaluación post-proceso (preguntas sobre el agente, e.g., ¿Quién estaba en el balcón?) o medidas de comprensión on-line (tiempos de lectura, Cuetos y Mitchell 1988). Muchos investigadores confirman que los nativos hispanohablantes prefieren identificar como agente de la oración relativa (*was on the balcony*) al primer antecedente de la frase (*servant*) empleando una estrategia de adjunción alta (Carreiras y Clifton, 1999). Es interesante destacar que, al contrario de los monolingües, los bilingües no muestran preferencia alguna al procesar frases ambiguas. Fernández (2003) analizó la preferencia de adjunción en monolingües angloparlantes y en bilingües de español/inglés. A todos los participantes se les pidió, en primer lugar, que leyeran oraciones predicativas complejas que incluían subordinadas de relativo parecidas a las mencionadas (*Someone shot the servant of the actress who was on the balcony*) y, en segundo lugar, que contestaran a algunas preguntas (e.g., ¿Quién estaba en el balcón?). El objetivo de esta tarea fue observar si los participantes usaban una estrategia de adjunción alta, como hacen los monolingües hispanohablantes (*the servant was on the balcony*) o, al contrario, una estrategia de adjunción baja, que es común en angloparlantes (*the actress was on the balcony*). Como predicho, los monolingües de inglés prefirieron una estrategia de adjunción baja (73%). Sin embargo, los bilingües Inglés/Español no mostraron preferencia clara hacia una estrategia de adjunción específica, ya que el 49% de las veces optaron por una estrategia alta, mientras que en el 51% de los casos por una estrategia baja.

Dussias (2001), comparó monolingües angloparlantes vs. bilingües de Inglés/español. A todos los participantes se les pidió que, en primer lugar, leyeran oraciones predicativas en inglés y, posteriormente, contestaran a unas preguntas sobre estrategias de adjunción del agente. Los datos mostraron que los monolingües angloparlantes prefirieron la estrategia típica del inglés (la baja) en el 86% de los casos. Sin embargo, la selección de la estrategia baja se redujo hasta el 56% para los bilingües. El hecho de que los bilingües no demuestren ninguna preferencia de adjunción específica implica que ambos idiomas se activan simultáneamente y se influencian de una forma que las preferencias sintácticas de procesamiento en un idioma cambian bajo la influencia del otro idioma.

Modelos teóricos para explicar la coactivación entre idiomas en bilingües. Como ya mencionamos anteriormente, uno de los objetivos del presente trabajo es evaluar el manejo de la coactivación entre idiomas por parte de los profesionales de la traducción sirviéndonos de la observación de cómo procesan las estructuras sintácticas ambiguas entre idiomas. Estas estructuras nos permitirán observar cómo funciona la activación de los mecanismos de input en la LF y output en la LM en cuanto a sintaxis durante las tareas de lectura para repetir (en el mismo idioma) y lectura para traducir.

Los dos modelos teóricos de naturaleza psicolingüística que enmarcan este aspecto de la presente investigación -y que pueden integrarse para explicar la modulación en el procesamiento sintáctico por parte de los profesionales en función de la tarea a desarrollar- son la Teoría del Modo Lingüístico (*Language Mode Theory*) de Grosjean (1997; 2001; 2013) y el Modelo de Competición (*Competition Model*) de MacWhinney (1992). Según Grosjean, la relativa activación o coactivación de los dos idiomas del bilingüe depende del contexto lingüístico. Hasta un bilingüe puede adoptar un "modo monolingüe" cuando el contexto requiere el uso de un solo idioma. Sin embargo, cuando los profesionales ejecutan su tarea, tanto la LF como la LM se activan, ya que las dos se necesitan, para la comprensión y la producción, respectivamente (Grosjean, 2013).

De esta manera, el modelo predeciría que la resolución de las ambigüedades sintácticas en el presente planteamiento dependería de si la tarea abarca uno (lectura en español para repetir en español) o dos idiomas (lectura en español para traducir hacia el inglés). Por otro lado, según el Modelo de

Competición de MacWhinney (1992), el nivel de idioma en la L2 lleva al desarrollo de nuevas estrategias que pueden emplearse de forma flexible para reducir la interferencia causada por la L1. Conforme los hablantes se mueven hacia el dominio de la L2, ésta se reestructuraría de una forma que evitaría la dependencia y transferencia de patrones propios de la L1.

Conforme los aprendices novatos se convierten en expertos, desarrollan una serie de estrategias que les permiten el uso directo de las estrategias de la L2 en vez de transferir las estrategias de la L1 a la L2, ya que "si las formas meta se filtran a través de la L1, el aprendiz nunca será capaz de detectar un desajuste entre las formas ya aprendidas y las formas propias de la lengua meta" (MacWhinney, 1992: 6). Ambos modelos subrayan la idea de que los usuarios expertos desde el punto de vista lingüístico son capaces de detectar el desajuste entre su L1 y L2 (MacWhinney, 1992) y replantear su aproximación a la L2 evitando la interferencia. Para lograrlo, las personas modulan su funcionamiento cognitivo (mecanismos de procesamiento del input y del output) según las demandas de la tarea que necesitan llevar a cabo (Grosjean, 2013), adoptando las estrategias propias de la lengua meta (MacWhinney, 1992).

Procesamiento de frases idiomáticas

Como ya mencionamos anteriormente, en la literatura se ha observado que una de las habilidades más importantes a la hora de traducir es la recuperación de equivalentes de traducción (Christoffels at al., 2003; Christoffels et al., 2006; Gerver, 1976; Macizo y Bajo, 2006; Paradis, 1994). La existencia de conexiones cross-lingüísticas directas entre equivalentes de traducción es muy plausible (de Groot y Christoffels, 2006), sobre todo en el caso de fragmentos lingüísticos multi-palabra, como frases hechas, fórmulas, refranes, formas idiomáticas en general; esta idea, además, es coherente con las observaciones sobre pericia maduradas en la literatura basada en resolución de problemas, que abogan por un almacenamiento del conocimiento, por parte de los expertos, en forma de *chunks* (fragmentos). Las expresiones multi-palabra (formas idiomáticas o idioms) permiten el estudio del fenómeno del *chunking* (tanto en observación de la conducta lingüística en la L1, como en la L2 o en tareas traductoras). El almacenamiento de soluciones traductoras por fragmentos implicaría, en primer lugar, el almacenamiento en memoria de formas multi-palabras como estructuras holísticas en la L1 (e.g., *Mejor sólo que mal acompañado*). En segundo lugar, implicaría el mismo almacenamiento holístico en la L2 (e.g., *Better to be alone than in ill company*), y una conexión directa entre las dos unidades holísticas (la de la L1 y la de la L2).

De Groot y Christoffels (2006) apuntan que la ocurrencia continua de unidades lingüísticas de ese tipo en los dos idiomas del bilingüe crea asociaciones directas en memoria entre equivalentes de traducción. El interés del presente trabajo estriba en suponer que, en el caso específico de los profesionales, cada evento de traducción fortalecería el vínculo (el trazo de memoria) entre los equivalentes. Cuanto más frecuente la co-ocurrencia de los equivalentes de traducción, más fuerte la conexión en memoria entre ellos (de Groot y Christoffels, 2006). Paradis (1994) afirma que los traductores expertos explotarían esta ruta directa entre equivalentes más que los bilingües no entrenados o los traductores menos expertos. En consecuencia de ello, debido a la práctica profesional, los traductores expertos deberían de dedicar menos recursos cognitivo a la recuperación de equivalentes de traducción (multi-palabra) entre idiomas, que debería de desarrollarse de manera más automática (más rápida y eficiente; Segalowitz, 2010), debido a un cambio cualitativo en el funcionamiento de los procesos computacionales subyacentes a la recuperación de la correspondencia.

En las siguientes páginas realizaremos un análisis detallado de las expresiones idiomáticas, tanto su definición como las principales teorías y hallazgos empíricos en relación al procesamiento de expresiones idiomáticas primero en personas monolingües y, tras esto, en personas bilingües.

Definición de expresión idiomática y su utilidad en el estudio de procesos cognitivos básicos

Las expresiones idiomáticas (e.g., levantar el vuelo) son expresiones multi-palabra, convencionales en un idioma, cuyo significado semántico no puede derivarse de la suma de los significados de sus componentes (Cacciari y Tabossi, 1988). Estas expresiones son muy comunes: casi la mitad de lenguaje que usamos a diario incluye expresiones idiomáticas (Erman y Warren, 2000; Foster, 2011; Howarth, 1998). En el ámbito de la psicolingüística y de la lingüística, las expresiones idiomáticas han sido a menudo objeto de estudio; los autores han intentado entender cómo se procesan y representan en el léxico de la L1 y L2.

La ventaja idiomática. Los estudios empíricos han demostrado de forma consistente que los hablantes nativos procesan las expresiones idiomáticas más rápidamente que las formas literales correspondientes (Conklin y Schmitt, 2012; Tabossi, Fanari, y Wolf, 2009).

En la literatura bilingüe, también hay muchos estudios que muestran diferencias cuantitativas entre el procesamiento de formas idiomáticas vs. no-idiomáticas; lo que se suele encontrar es una ventaja en el procesamiento idiomático. Esta ventaja se ha observado empleando varias metodologías experimentales, midiendo tiempos de reacción (e.g., Conklin y Schmitt, 2008; Jiang y Nekrasova, 2007; Wolter y Gyllstad, 2011; Wolter y Gyllstad, 2013; Wolter y Yamashita, 2014; Yamashita y Jiang), con tareas de lectura auto-administrada (e.g., Cieślicka, 2011; Conklin y Schmitt, 2008), tareas de recuerdo con clave (Yeganehjoo y Yap, 2009; Yeganehjoo, Yap, Abdullah, y Tan, 2012), paradigmas de campo visual dividido (Cieślicka, 2012; Cieślicka y Heredia, 2011), paradigmas cross-modales (Cieślicka, 2006, 2013) y registro de movimientos oculares (e.g., Heredia, Olivares, y Cieślicka, 2014; Siyanova-Chanturia, 2013; Siyanova-Chanturia, Conklin, y Schmitt, 2011; Siyanova-Chanturia, Conklin, y van Heuven, 2011; Underwood, Schmitt, y Galpin, 2004).

Más concretamente, los bilingües parecen acceder al significado idiomático de las frases tan rápidamente como los nativos monolingües. Conklin y Schmitt (2008), por ejemplo, realizaron un experimento de lectura auto-administrada mediante ventana móvil comparando monolingües y bilingües muy fluidos en comprensión de frases idiomáticas incrustadas en historietas altamente sesgadas. Las historietas sesgaban hacia la interpretación literal o figurada de las frases idiomáticas. Se encontró, en general, que las frases idiomáticas se leían más rápidamente que las frases literales, tanto en nativos como en bilingües. Ya que no se encontraron diferencias entre grupos, los autores razonaron que los hablantes bilingües pueden alcanzar las mismas ventajas en procesamiento idiomático mostradas por los hablantes nativos. Jiang y Nekrasova (2007) compararon nativos monolingües de inglés y bilingües chino-español en una tarea de juicio de gramaticalidad de frases, en la que pidieron a los participantes que determinaran si una frase (idiomática vs. control) era correcta. Ambos grupos mostraron una ventaja en el procesamiento idiomático, ya que las respuestas a las expresiones idiomáticas fueron más rápidas. Por lo que se desprende que los hablantes bilingües pueden alcanzar el mismo nivel de sensibilidad idiomática alcanzado por los nativos monolingües.

Modelos de procesamiento idiomático en monolingües

Son varios los modelos teóricos que intentan explicar la ventaja idiomática, tanto en comprensión, como en recuperación. Los modelos teóricos más importantes pueden agruparse en tres enfoques principales: modelos no-composicionales, composicionales e híbridos de procesamiento idiomático.

Modelos no-composicionales de procesamiento idiomático. Según este enfoque, las expresiones idiomáticas serían entradas léxicas independientes almacenadas en memoria de forma unitaria, holística. Esta idea implica que el significado figurado de la expresión idiomática no está directamente relacionado con el significado literal de sus componentes individuales (lemas). Algunos de los modelos más importantes incluidos en este enfoque son el Modelo de Procesamiento Literal (*Literal processing Model*) de Brobow y Bell (1973), el Modelo de la Representación Léxica (*Lexical Representation Model*) de Swinney y Cutler (1979) y el Modelo de Acceso Directo (*Direct Access Model*) de Gibbs (1980, 2000). A pesar de que estos tres modelos difieran en cuanto al cómo y en qué base temporal los significados idiomáticos se recuperarían, todos apoyan la idea de un significado idiomático semánticamente independiente de los significados de los lemas que componen la expresión idiomática (Caillies y Butcher, 2007). Así pues, la ventaja idiomática se debería a que estas formas funcionan como unidades léxicas unitarias a las que se accedería directamente.

Modelos composicionales de procesamiento idiomático. Los modelos composicionales proponen que las expresiones idomáticas varían en función de su composicionalidad (e.g., Modelo de la Polisemia inducida por la Frase -*Phrase-Induced Polysemy Model*- de Glucksberg, 1993, 2001; Modelo de Resonancia de la Saliencia Literal - *Literal Salience Resonance Model* - de Cieślicka, 2004). Estos modelos comparten el supuesto según el cual los significados de los lemas de las frases idiomáticas contribuyen a la construcción del significado del mismo. Por consiguiente, estos modelos rechazan la idea de una recuperación unitaria de la expresión idiomática en memoria, como si se tratara de una secuencia lexicalizada y pre-fabricada; por el contrario, postulan que la expresión idiomática requiere del procesamiento semántico y análisis sintáctico on-line de sus componentes individuales (e.g., Cacciari y Glucksberg, 1991; Cacciari y Tabossi, 1988, 2014; Cieślicka, 2006; Glucksberg, Brown, y McGlone, 1993; Titone y Connine, 1999). La Hipótesis de la Configuración (*Configuration Hypothesis*, Cacciari y Tabossi, 1988), por ejemplo, plantea una representación distribuida de la forma idiomática en el lexicón mental. La premisa fundamental de este modelo es que la expresión idiomática estaría asociada a una red específica de palabras, que son las mismas que reciben activación durante el procesamiento de material literal (no figurado). Al leer una frase idiomática, la frase se procesaría literalmente hasta alcanzar y recuperar del lexicón mental la clave de la expresión (*Idiom Key);* la clave es la palabra de la expresión idiomática en que se desencadenaría el significado figurado del mismo (Cacciari y Tabossi, 1988). Sólo en este punto, los lemas incluidos en la frase idiomática se reconocerían como parte de una red idiomática y el significado idiomático se recuperaría de la memoria.

Según los modelos composicionales, el uso repetido de frases idiomáticas sería responsable de una mayor fuerza asociativa entre los nodos de los componentes léxicos individuales que componen la expresión idiomática. Como consecuencia, la ventaja en el procesamiento de las expresiones idiomáticas dependería de si estas conexiones se crean, permitiendo una recuperación directa del significado idiomático del lexicón mental (Cieślicka, 2008). Los datos que respaldan los modelos composicionales proceden de la demostración de que la composicionalidad (es decir, la medida en que los significados de los lemas individuales contribuyen al significado idiomático global) juega un papel fundamental en la comprensión de los idioms. Gibbs, Nayak, y Cutting (1989), por ejemplo, mostraron que los adultos tardaban más tiempo en decidir que las frases idiomáticas no-composicionales eran semánticamente aceptables comparados con los composicionales. Según Glucksberg (2001) el efecto de facilitación observado durante la comprensión de las expresiones idiomáticas composicionales (*pop the question*) se debe al solapamiento entre el resultado del análisis literal ejecutado on-line y el significado idiomático global; por el otro lado, en el caso de los idioms no-composicionales (*kick the bucket*), el análisis literal no se solapa con el significado figurado, haciendo que el proceso, en general, sea más lento.

Modelos híbridos de procesamiento idiomático. Un enfoque intermedio, el híbrido, plantea que las expresiones idiomáticas son a la vez composicionales y no composicionales (Titone y Connine, 1999). Los modelos híbridos proponen que la recuperación del significado figurado aflora cuando una porción suficiente de la frase idiomática se ha procesado de forma literal, hasta alcanzar la *clave* de la frase idiomática (en consonancia con lo que plantea la Hipótesis de la Configuración de Cacciari y Tabossi, 1988). De ahí que la clave de la frase idiomática desencadenaría el significado figurado, cuyo procesamiento se desplegaría en paralelo con el análisis literal de la frase. Esta es la diferencia fundamental entre el Modelo Híbrido de Titone y Connine (1999) y la hipótesis de la Configuración (Cacciari y Tabossi, 1988): el primero supone que la computación literal de la frase idiomática se mantiene activa hasta después de que se haya recuperado el significado figurado. Siguiendo el mismo razonamiento, Cutting y Bock (1997) apuntaron que a pesar de que las frases idiomáticas se almacenen y representen como conjuntos (*chunks*), no se trata de entradas léxicas sin estructura interna.

Como sostienen Sprenger, Levelt, y Kempen (2006), los modelos híbridos comparten la idea según la cual las expresiones idiomáticas son unitarias (holísticas) en el sentido de que requieren su propia entrada léxico-conceptual, y composicionales porque la activación se propaga hacia los lemas individuales que componen la expresión; estos lemas particulares funcionan como una red cuando se hallan dentro de una expresión idiomática, pero su funcionamiento no se limita a ello (Sprenger et al., 2006). Una versión reciente de los modelos híbridos que puede aplicarse tanto a los procesos de comprensión como de producción es el Modelo del Superlema (*Superlemma Model*), de Sprenger et al. (2006). El Superlema sería la representación unitaria y holística de la frase idiomática a nivel sintáctico, que incluiría los lemas individuales que configuran la frase idiomática, y las propiedades sintácticas que los conectan. El superlema estaría conectado tanto al concepto unitario de la frase idiomática como a la semántica de los lemas específicos. Según este enfoque, al procesar una frase idiomática como *Estirar la pata* durante la fase de comprensión, los lemas asociados a cada palabra se activarían dos veces, mediante una ruta de procesamiento composicional en línea, y como parte del superlema (ruta no-composicional) (Carrol y Conklin, 2014). Esta doble activación, sin lugar a duda, implicaría una ventaja en comparación con el procesamiento de formas no-idiomáticas, que sólo pueden procesarse a través de la activación de los lemas asociados a cada palabra de la expresión literal. Sin embargo, la activación del significado figurado de *Estirar la pata* requiere también la selección del superlema por encima de la activación de los lemas particulares. El superlema (que contiene las restricciones sintácticas que acompañan el idiom) competiría con los lemas particulares "estirar = alargar" y "pata = extremidad de un animal", y otros superlemas parecidos en significado y potencialmente activos, como "pasar a mejor vida". Según Sprenger et al., en esta competición entre lemas coactivados, la probabilidad de seleccionar el superlema objetivo y su concepto subyacente (a nivel semántico) depende del "ratio de la medida de activación del superlema por encima de la activación total de todos los lemas de la frase idiomática en el lexicón mental" (Sprenger et al. 2006: 177). En este punto, la frase idiomática se reconocería como tal si la activación del superlema supera un umbral crítico. Según el modelo, el nivel de activación del superlema en monolingües dependerá del nivel de experiencia con la expresión y del nivel de solapamiento entre los significados de los lemas particulares y del superlema.

Modelos híbridos de procesamiento idiomático en bilingües

Contamos con algunos estudios que han aplicado el enfoque teórico híbrido al procesamiento idiomático bilingüe. Carroll y Conklin (2014), por ejemplo, propusieron que unas conexiones más fuertes y directas dentro de la red idiomática promueven un acceso más directo y rápido al superlema, y que este acceso se crea gracias al incremento de la frecuencia de encuentros con la frase idiomática. En su estudio observaron que los bilingües chino-inglés fueron más rápidos ejecutando una tarea de decisión léxica en su L2 (inglés) cuando una palabra target (i.e., *feet*) estaba precedida por las palabras iniciales de una frase idiomática china transliterada (*draw a snake and add…*, que carece de significado en Inglés). Comparando el efecto de prime en la palabra target relacionada con la transliteración del expresión china (*feet*) vs. el efecto relativo a una palabra target de control, no relacionada (pelo); observaron tiempos de reacción más rápidos en respuesta a la palabra *feet*. Los autores explicaron sus datos afirmando que las palabras iniciales de la transliteración de la frase idiomática china activaron el concepto unitario de la expresión, compartida entre los dos idiomas del bilingüe. Este concepto, según los autores, propagó activación tanto hacia sus propiedades léxicas (lemas) como sintácticas (superlema) haciendo que la forma léxica target (*feet*) estuviera disponible en la L1 o directamente en la L2 (de haberse creado conexiones lo suficientemente fuertes entre idiomas). Dado que la forma en L1 es un equivalente de traducción del target presentado, la facilitación para la palabra inglesa *feet* se observó de cualquier forma.

Yeganehjoo y Yap (2009), al igual que en estudios con monolingües, observaron que las frases idiomáticas parecen representarse tanto de forma composicional como no-composicional incluso en el lexicón mental de la L2. En su investigación con bilingües procesando en su L2, hallaron efectos de priming en la producción de frases idiomáticas (*hit the sack*) y literales (*move the sack*) al presentar como prime uno de sus componentes (*sack*; prime de identidad). A través de este dato, confirmaron que sí se produce acceso a los lemas individuales de la expresión, al igual que se accede a cualquier otro lema durante el procesamiento del lenguaje literal. Además, observaron que el efecto del prime de identidad era más evidente en el caso de expresiones idiomáticas, y propusieron que se debía a que las expresiones idiomáticas se almacenan y representan como fragmentos (chunks) incluso en el lexicón de la L2. Sus datos confirmaron que los lemas incluidos en la frase idiomática están conectados a un concepto común, *irse a dormir*, conexión que no estaría disponible en el caso de la frase literal *move the sack*. Yeganehjoo y Yap (2012) también confirmaron que las frases idiomáticas se almacenan como fragmentos, y que el incremento de la experiencia lingüística llevaría a conexiones más fuertes entre la expresión en la L2 y el concepto subyacente, creando una ruta directa de acceso al procesamiento y recuperación de la idiomaticidad en la L2.

En ámbito bilingüe, así pues, cuando ambos idiomas entran en juego, por ejemplo en tareas de traducción o cuando los bilingües se encuentran inmersos en un contexto de cambio de idioma, lo que será determinante para realizar con éxito la tarea es el nivel de experiencia cross-lingüística con la expresión idiomática (tanto en L1 como en L2) y el nivel de solapamiento (congruencia) entre las formas idiomáticas en la L1 y la L2. Por ejemplo, para traducir de forma rápida y eficiente la expresión *kick the bucket*, debería de pasar lo siguiente: una vez que el superlema de la L1 (*kick the bucket*) ha recibido una activación superior a la que han recibido los lemas individuales incluidos la expresión, "kick=punt" y "bucket=pail", permitiendo la recuperación del significado figurado, el equivalente de traducción en la L2, *estirar la pata*, también necesitaría de un nivel de activación que supere la activación de los nodos de traducción individuales, es decir, "Kick=patear" y "bucket=cubo".

Si quisiéramos ser más concretos, la literatura que adopta el enfoque híbrido hace hincapié en dos factores moduladores del procesamiento idiomático en bilingües que son coherentes con las observaciones realizadas en estudios monolingües (Sprenger et al., 2006; Titone y Connine, 1999): la experiencia en el uso bilingüe de las expresiones idiomática y la congruencia de las formas idiomáticas entre los idiomas empleados. Esta última consideración es fundamental para el objetivo del presente trabajo, ya que tanto la congruencia entre idiomas como la experiencia lingüística serán objeto de estudio a través de su manipulación directa.

Experiencia bilingüe y procesamiento idiomático. Como se acaba de mencionar, el enfoque híbrido propone que el acceso idiomático al superlema depende del nivel de exposición a la forma idiomática. Hay estudios que ya han tomado en consideración este aspecto (e.g., Yeganehjoo y Yap, 2012).

En un estudio con movimientos oculares, Siyanova-Chanturia, Conklin, y van Heuven (2011) compararon el procesamiento de formas idiomáticas caracterizadas por una frecuencia de uso variable (por ejemplo, *marido y mujer* vs. *mujer y marido*). Los autores compararon nativos vs. bilingües poco fluidos vs. bilingües muy fluidos. Los nativos y bilingües muy fluidos leyeron las formas idiomáticas más frecuentes con mayor rapidez que las menos frecuentes; sin embargo, los bilingües menos competentes no mostraron diferencias en los tiempos de lectura de formas frecuentes vs. poco frecuentes. Estos resultados confirman que distintas experiencias en bilingüismo (exposición alta vs. baja al input en la L2) modulan la ventaja de procesamiento idiomático; una vez más, como se ha observado en el estudio de Yeganehjoo y Yap (2012), parece confirmarse que, al incrementar la experiencia en L2, los aprendices representan en memoria no sólo los ítems léxicos incluidos en la frase idiomática (tanto en la L1 como en la L2), sino la expresión en su conjunto, tanto en la L1 como en la L2 (Siyanova-Chanturia et al., 2011). Esta representación holística (definida como superlema en Sprenger et al., 2006) fluctúa como consecuencia de distintos tipos de experiencia bilingüe.

En otro estudio, Siyanova y Schmitt (2008) exploraron la influencia de la exposición al entorno de la L2 sobre la competencia idiomática de los aprendices basándose en la idea de que la adquisición exitosa de lenguaje prefabricado requiere una exposición natural a la L2 prolongada en el tiempo (Adolphs y Durow, 2004; Dörnyei, Durow, y Zahran, 2004). Compararon grupos con distintos niveles de exposición al entorno de habla de la L2 (no-exposición vs. menos de 12 meses de exposición vs. más de 12 meses), empleando una tarea de evaluación del conocimiento de expresiones idiomáticas en la L2. Simplemente, les pidieron a sus participantes que indicaran si conocían la expresión. Se observaron diferencias significativas entre los grupos de exposición vs. no exposición; además, obtuvieron una correlación significativa entre el tiempo transcurrido en el entorno de la L2 y el conocimiento del lenguaje idiomático, dato que avala la idea según la cual el incremento de la inmersión en el entorno de la L2 lleva a un mejor conocimiento de la idiomaticidad.

Para resumir, en la base de los estudios disponibles, parece demostrado que los bilingües muy competentes suelen mostrar la misma ventaja en el procesamiento idiomático mostrada por los nativos en su L1; además, el aumento de la sensibilidad hacia las formas idiomáticas parece ser consecuencia directa de un aumento de la exposición al entorno natural de habla de la L2.

Congruencia idiomática entre idiomas. Otro factor crítico que influenciaría el procesamiento de las expresiones idiomáticas en bilingües es la congruencia entre las expresiones idiomáticas en la L1 y L2. Las expresiones idiomáticas se distribuyen a lo largo de un continuum de especificidad lingüística, en el sentido de que el mismo concepto idiomático podría expresarse mediante nodos léxicos completamente idénticos o desiguales entre los dos idiomas en cuestión (Yamashita y Jiang, 2010). Por ejemplo, la L2 podría no contar con un equivalente de traducción totalmente congruente en la L1. Las expresiones idiomáticas congruentes entre idiomas son expresiones cuya traducción palabra por palabra es válida (i.e., *to break someone's heart* = *romperle el corazón a alguien*). Por el contrario, las frases idiomáticas incongruentes son expresiones cuya traducción palabra por palabra no es admisible para mantener el significado figurado entre idiomas (i.e., la expresión en inglés *to kick the bucket* y su traducción al español, *estirar la pata,* cuyo significado literal es *alargar la pierna*).

Cabe recordar que, según los modelos híbridos, el solapamiento cross-lingüístico entre los lemas y el superlema que conforman la frase idiomática es crucial para predecir la ventaja en el procesamiento idiomático vs. no-idiomático (i.e., Bortfeld, 2003; Caillies y Butcher, 2007; Gibbs et al., 1989). De ahí que cuando se presenta una expresión idiomática congruente, se facilita la traducción porque las entradas léxicas individuales de la expresión idiomática están compartidas entre idiomas (*break* = *romper*, *heart* = *corazón*), al igual que el significado idiomático de la frase (causar daño). Por el contrario, cuando hay que traducir una expresión incongruente entre idiomas, el significado idiomático (*morir*) fomentaría la activación de las entradas léxicas adecuadas en español (*estirar*, *pata*) que competirían con las entradas léxicas asociadas a la traducción literal de los lemas de la expresión en inglés (*kick* = patear, *bucket* = cubo). De este modo, la correspondencia cross-lingüística entre los ítems léxicos incluidos en una frase idiomática, a veces causa facilitación y otras veces puede causar interferencia (Wolter, 2006). La facilitación se daría en el caso de expresiones congruentes, mientras que habría interferencia en el caso de expresiones idiomáticas incongruentes. En apoyo a estas predicciones, hay pruebas empíricas que muestran que la facilitación asociada al procesamiento idiomático en bilingües depende de la congruencia entre la L1 y la L2 (Wolter, 2006; Wolter y Gyllstad, 2013), y que ésta es determinante a la hora de acceder a la forma idiomática de forma unitaria, es decir, al superlema. Por ejemplo, Wolter y Gyllstad (2011) presentaron un prime de tipo verbal a hablantes nativos de inglés y a bilingües Sueco-Inglés (L1/L2) y evaluaron la posible facilitación en el reconocimiento de un target sustantivo si la forma idiomática resultante verbo+sustantivo era congruente (i.e., *to join club*) versus incongruente (i.e., *to throw party*) entre los dos idiomas. Se observaron tiempos de reacción significativamente más rápidos en el caso de palabras target cuya combinación con el prime anterior formaba una frase idiomática congruente. La ventaja idiomática se vio, así pues, afectada por el solapamiento entre idiomas (para otros efectos de congruencia, ver Irujo, 1984; Wolter y Gyllstad, 2013; Yamashita y Jiang, 2010).

En producción, Irujo (1986) empleó una tarea de traducción y observó que las frases idiomáticas presentadas en inglés que mejor se comprendían y producían en el caso de bilingües español-inglés eran los congruentes. En cuanto a la traducción de frases idiomáticas, el único trabajo de investigación que ha explorado este tema es el de Irujo (1984, 1993). Se utilizaron 45 párrafos en español, cada uno de los cuales contenía una frase idiomática. Se manipuló la similitud de las frases idiomáticas entre idiomas: quince frases idiomáticas contaban con equivalentes de traducción idénticos en inglés, otros eran similares, y otros totalmente distintos. Irujo (1993) les pidió a sus participantes que tradujeran los párrafos al inglés. Se encontró que las frase idiomáticas congruentes eran más fáciles de traducir que los incongruentes, proporcionando pruebas adicionales de que hasta los hablantes fluidos de un segundo idioma se sirven de la L1 para la fase de producción idiomática, y que la medida de similitud cross-lingüística entre idiomas puede ser el factor que más marcadamente influencia la transferencia desde la L1 hacia la L2 durante el proceso de traducción. También se observó que en casos de omisión de la traducción, el sustituto más común era un sinónimo literal o una paráfrasis de la expresión idiomática fuente.

En comprensión, Wolter y Gyllstad (2013) y Yamashita y Jiang (2010) compararon hablantes nativos y bilingües fluidos en una tarea de evaluación de frases en Inglés; los resultados de los dos estudios fueron similares: la congruencia no surtió efecto alguno en las respuestas de los monolingües nativos; sin embargo, en el caso de los bilingües, las respuestas a las expresiones idiomáticas congruentes fueron más rápidas.

Wolter and Gyllstad (2011) apuntan que una explicación plausible para el reconocimiento más rápido de las formas congruentes por parte de los bilingües es la activación cross-lingüística paralela de equivalentes de traducción. También afirman que el efecto de facilitación observado cuando los bilingües procesan las frases idiomáticas congruentes es coherente tanto con los modelos híbridos de procesamiento idiomático (e.g., Sprenger et al., 2006; Titone y Connine, 1994) como con modelos más generales de selección léxico/semántica (e.g., Modelo Jerárquico Revisado -*Revised Hierarchical Model- de* Kroll y Stewart, 1994). Yamashita y Jiang (2010) emplearon una tarea de evaluación de frases comparando hablantes nativos de inglés y bilingües inglés-japonés; analizaron aciertos y tiempos de reacción al ejecutar la tarea. Los bilingües fueron seleccionados en la base de su competencia en la L2, y se compararon bilingües muy competentes vs. poco competentes. Los autores también compararon los datos relativos a frase idiomáticas congruentes vs. incongruentes. Los bilingües poco competentes cometieron más errores y fueron más lentos a la hora de evaluar formas idiomáticas incongruentes. Los bilingües muy competentes también cometieron más errores al evaluar expresiones incongruentes; sin embargo, la diferencia entre los tiempos de respuesta a las frases idiomáticas congruentes vs. incongruentes no fue significativa en este grupo. El efecto de congruencia mostrado por el grupo bilingüe de alta competencia sugiere que es más difícil fijar una representación en el lexicón de la L2 para una frase idiomática incongruente, ya que éstos requieren de una elevada exposición a la L2. Estos datos indican que hasta los bilingües más competentes podrían seguir dependiendo del proceso de filtraje por el lexicón de la L1, al menos en cuanto a las frases idiomáticas incongruentes se refiere, lo que causaría una ventaja de procesamiento para las expresiones congruentes (como predecirían los modelos híbridos de procesamiento idiomático y el Modelo Jerárquico Revisado). Yeganehjoo y Yap (2012) también investigaron el impacto de las similitudes cross-lingüísticas en la representación y producción de expresiones idiomáticas en la L2 (inglés), por parte de bilingües persa-inglés. Emplearon una tarea de *priming* con recuerdo con clave en la que los participantes tenían que memorizar idioms congruentes (en inglés). Luego, cuatro tipos de palabras prime críticas se presentaron de forma auditiva para la fase posterior de recuerdo con clave: el concepto compartido entre la L1 y la L2, unidades léxicas relacionadas con la L1 y L2, unidades léxicas relacionadas sólo con la L1, la clave de cada frase idiomática y, finalmente, palabras control. Simultáneamente, una palabra de aviso (el sujeto de la frase idiomática) aparecía en pantalla, y los participantes debían contestar produciendo la forma idiomática correspondiente. Se midió el intervalo temporal entre la presentación del prime (y de la palabra preparatoria) y el comienzo de la fase de producción. Los resultados indicaron que el concepto compartido entre la L1 y la L2 fue un input débil para desencadenar la producción de la expresión en la L2, confirmando la presencia de una conexión débil entre el concepto y la expresión idiomática en la L2. También se observaron tiempos de reacción lentos como consecuencia de la necesidad de seguir una ruta menos directa, es decir, la mediación léxica a través de la L1. De hecho, los estímulos primes presentados en la L1 (persa) influían en la producción de frases idiomáticas en la L2 ya que, a pesar de no estar relacionadas con las frases idiomáticas de la L2, estaban relacionados con la frase equivalente en L1 (persa), activaban la configuración de la expresión idiomática en la L1, y permitían la mediación a través del equivalente de traducción de la L1 para producir la frase en la L2.

Los datos mencionados hasta ahora confirman la influencia de la L1 en la L2, un asunto que se ha demostrado ampliamente en la literatura (Kroll y Stewart, 1994; Sunderman y Kroll, 2006; Talamas, Kroll y Dufour, 1999). Además, todos los estudios y los modelos citados coinciden en afirmar que, mediante el incremento de la exposición a la L2, se crearían conexiones directas entre los superlemas de la L2 y los conceptos, de una forma que permitiría un procesamiento idiomático en la L2 independiente del lexicón de la L1 (procesamiento de tipo más conceptual). Los resultados, en general, sugieren que la adquisición de las formas co-ocurrentes en la L2 es un proceso que requiere tiempo, y que tanto la congruencia entre los equivalentes en la L1 y L2 como la cantidad de input recibido en la L2 afectan, de forma interactiva, en la adquisición.

La novedad de la presente investigación reside en que, hasta donde llega nuestro conocimiento, este es el primer estudio que investiga la relación potencial entre el procesamiento idiomático, el reparto de recursos cognitivos implicados tanto en procesamiento lingüístico como en tareas no lingüísticas que posiblemente recluten los mismos procesos y las fluctuaciones causadas por distintas experiencias en bilingüismo.

Resumiendo brevemente lo mencionado hasta ahora, los datos procedentes de los estudios con expresiones idiomáticas confirman la coactivación de idiomas del bilingüe a pesar de que un solo idioma esté en uso, lo que incrementa las demandas cognitivas impuestas sobre los procesos de control. En el presente planteamiento, esperamos que distintas experiencias bilingües modulen de forma distinta la fuerza de las asociaciones entre los lemas y los superlemas en la L1 y L2, además del reparto de recursos cognitivos a la hora de manejar formas idiomáticas entre idiomas.

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CHAPTER I

INTRODUCTION

PREFACIO

Without a shadow of a doubt, nowadays being bilingual is more the rule than the exception; already in 1982, in his book, *Life with two languages*, Grosjean emphasized the idea that it is almost impossible to find a country that could be considered exclusively monolingual. Moreover, due to the recent phenomena of globalization and free circulation of goods and people, during the last 50 year there has been growing interest and investment to support the translation and interpreting activity. It is no surprise, then, that the issues of bilingualism, translation and interpreting are under the spotlight of research both in the fields of psychology and translation: we count on a large amount of specialized literature focusing on the issue of second language acquisition from quite diverse viewpoints. Researches have embraced a wide range of methodologies, experimental paradigms and theoretical frameworks, confirming that the study of the linguistic phenomena underlying bilingualism is vast, complex and constantly evolving.

In 1994 Mike Dillinger pointed out that it is not enough to encourage interpreters and translators to carry out empirical research, since they often commit basic errors related to the experimental design and statistical analysis, due to the fact that they are not used to employ the experimental approach; at the same time, it is not quite enough to approach the study of translation as an experimental researcher, since they often make mistakes linked to the observation of translation practice, due to the lack of consistent experience in translation activity[2]. The only reasonable solution, according to Dillinger (1994), is to cooperate in research, since neither group shows the necessary practice in the domain they focus on.

For this reason, as a translator interested in the experimental approach, when I completed my graduate studies in Translation and Interpreting, I realized that I lacked the knowledge and the tools to conduct empirical research

[2] *Writer's Note*: In the present thesis, the terms "translator" and "translation" refer both to translation and interpreting activities. When necessary, a clear distinction is made between the two groups through the use of the term "interpreter".

on translation from a cognitive perspective. Like all translators, I devoted many years of my education to improve the translation process itself, i.e., to develop those skills that would improve the effectiveness and speed of the translation service offered to customers. However, I always felt interested in what allegedly happened in the "black box"; I could function pretty well in my work environment, translating on a daily basis, interpreting, revising texts in my second language; however, still I did not know how all this happened, as my personal experience had been based on a trial-and-error learning strategy.

When I had the chance to approach the field of psychology and, more specifically, the experimental approach to bilingualism and translation, obviously I did not let the chance pass by; thus I decided, in a sense, to start from scratch. I began to realize that there exist effective and accurate ways of understanding what happens in the mind of a translator and that, rather than a black box, it works like a system: human translation does not function as Google Translator, translators are not walking dictionaries, and surely it is possible to raise a bilingual child, but not a translator. Translation ability has to be trained and it changes according to the individuals' interaction with the environment. Rain or shine, most people will say that the important thing, after all, is that the process ensures that the input becomes output; otherwise, there would be no translation. However, the translation process cannot merely be considered as an alternation of inputs and outputs.

It is worth considering *how* the process is accomplished, and the relationship between the process and the environment; the translation process is a system within other systems, i.e., "the sum of the parts that operate independently but in synergy, in order to achieve the expected results or products, based on the needs" (Kaufman, 1993). Therefore, only a) exploring the functioning of the cognitive processes underlying efficiency in translation performance, b) taking into account the impact of behavior on the environment and vice versa, and c) adopting a consistent interdisciplinary approach as proposed by the theory of systems (Bertalanffy, 1979) recurring patterns of data will plausibly be detected and used to guide training programs in translation towards the consistent and gradual improvement of performance.

This is the reason why in the last few years considerable attention has been paid to the need to focus research on interdisciplinary approaches, since they can provide a more comprehensive view and analysis of the interaction between different socio-linguistic and psychological systems related to language learning.

The present doctoral thesis explores the potential bridge between the psychological and translation studies' approach; we aim to operationalize insights from translatology through the use of a methodologically robust experimental design, based on the idea that translation expertise is a particular case of expertise in general (Sirén & Hakkarainen, 2002).

Overall, I will try to focus on those questions that professionals usually raise, whose answers play a fundamental role in the selection, training and evaluation of translators. Is it true that professional translators, compared to untrained bilingual, handle differently their languages and the cognitive regulation of resources due to consistent practice in their domain? Are there skills that are specific to translation expertise that cannot be detected in untrained bilinguals? How is the ease with which translators handle linguistic material between languages reflected in the balance between automaticity and cognitive control? As Dillinger (1994) points out, the answers to these questions are critical, as they can provide the elements on which to base the development of very high professional standards, proper training programs and, in general, the improvement of professional practice.

More concretely, as far as the structure of the introductory section is concerned, it will begin with the formulation of the concept of Professional Expertise, taking into account a) the theoretical contributions to the concept's formulation by the studies in the problem solving domain, b) their application to the translation activity, and c) the experimental approach adopted in the field of psycholinguistics. Therefore, the involvement of the concepts of automaticity and cognitive control to expertise will be explored, offering a brief overview of the perspectives aforementioned. The goal of the first part of the introduction is to define expertise in terms of the balance between automaticity and cognitive control, as a function of different types of bilingualism.

The second part of the introduction focuses on the analysis of those linguistic sub-skills that are essential for the translation task to develop quickly and efficiently; in order for this to happen, the task should consume as few cognitive resources as possible. In fact, when language processing requires fewer cognitive resources, the ability to execute the processes required by the translation task (e.g., monitoring the simultaneity of the comprehension and production processes, both orally and in writing) is enhanced; in the case of translation, a great amount of resources is needed to maintain the speed and efficiency throughout the process (Christoffels, de Groot, & Waldorp, 2003). There are specific sub-skills that are considered essential to "save" cognitive resources and guarantee the speed and efficiency (translation quality) of the process: a) the ability to modulate the co-activation of the source language (SL) and the target language (TL), avoiding translation errors and / or episodes of interference (Grosjean, 2013; MacWhinney, 2001; Ruiz, Paredes, Macizo, & Bajo, 2008); b) the ability to retrieve translation equivalents quickly and efficiently (Christoffels, de Groot, & Kroll, 2006; Christoffels et al., 2003). Because the translation task runs on fragments –*chunks*- of speech (Christoffels et al., 2006), since professionals hardly translate or interpret single words (Christoffels et al., 2003), the role played by the two sub-skills mentioned above will be analyzed at the sentence level, in order to maintain an ecologically valid approach to the real translation task.

EXPERTISE IN TRANSLATION: BALANCE BETWEEN AUTOMATICITY AND COGNITIVE CONTROL

The concept of Expertise in problem solving

Studies on expertise in the problem solving domain have been carried out from different perspectives, usually pivoting on two fundamental intuitions, since superior performance in a task is attributed either to general or to specific characteristics of individuals. These two perspectives, "general characteristics" versus "specific skills" have also been linked to the distinction between the "inherited" and the "acquired". Galton (1869), for example, in his pioneer study on the origin of individual differences, concluded that the quality of execution of a task is directly correlated with general capacities genetically inherited.

Other later works continued to reflect this duality of approaches in the study of expertise; on the one hand, many researchers in the field of problem solving attempted to identify general heuristics required to solve any problem (see Mayer, 1983 for a review). According to this view, individuals apply very general heuristics to all situations and also transfer these heuristics to more specific areas of knowledge. The expert performance, from this point of view, would be shown by people who have ability to use general heuristics in problem solving.

Nevertheless, the studies that focus on specific skills and compare experts vs. novices, do not indicate that the individuals who are skilled in a specific area of knowledge have stored in the long-term memory problem solving heuristics that the novices lack; rather, the use and activation of certain heuristics, useful to solve specific problems, is different and more efficient in experts, since they own specific domain knowledge (Holyoak, 1991). Then, according to this perspective, expertise is based on the application of knowledge and skills that are domain-specific.

Numerous studies, first in chess (Chase & Simon, 1973; de Groot, 1965), in the field of physics (Chi, Glaser & Feltovich 1981; Larkin, McDermott, Simon, & Simon, 1980) and then in other domains, showed that expertise depends primarily on specific domain knowledge, reflected in the specificity of skills and inferential models. For example, de Groot (1965) and Chase and Simon (1973) found that expert chess players do not differ from other people in general intelligence or memory capacity; rather, when solving a chess problem, they use memory resources in a more efficient manner.

Similarly, Ericsson (1996, 2003a, 2003b), Kliegl, Smith, and Baltes (1989) demonstrated that the use of specific knowledge structures was at the basis of increased memory capacity in training and superior memory performance by experts within their domain (see Ericsson, 1996, for a review).

Consequently, latest research emphasizes the specificity of some skills and problem solving strategies. This lets us talk about domain expertise and, from this approach, about expertise in language use (bilingualism) and expertise in translation.

Expertise in bilingualism and translation

Segalowitz and Frenkiel-Fishman (2005), Segalowitz and Hulstijn (2009) suggested that one of the most useful psychological construct for the understanding of how practice leads to expert performance is automaticity. De Groot and Christoffels (2006) claimed that training in translation tasks, which allows understanding and retrieval processes to be faster and more automatic, plays a key role in the allocation of cognitive resources, since the more rapid and automatic are the understanding and retrieval processes, the more the availability of cognitive resources that allow to avoid translation errors/ interference during the production phase.

However, an additional feature that makes the difference between expert translators, novices and bilinguals: the ability to maintain high levels of cognitive control while performing the task (Bajo, Padilla, & Padilla, 2000).

The investigation of the differences between learners with varying degrees of expertise has progressively and clearly illustrated the close relationship between automaticity and cognitive control (cf., for example, Pressley & McCormick, 1995; Schunk & Zimmerman, 2007). The distinction between automatic and controlled processes was proposed by several researchers (Kahneman, 1973; LaBerge & Samuels, 1974; Posner & Snyder, 1975; Schneider & Shiffrin , 1977; Shiffrin & Schneider, 1977) who noted that different cognitive tasks involved different "attentional efforts". These authors also showed that the continuous and prolonged practice over time allows cognitive operations to run faster and effortless. Nevertheless, some cognitive operations still require more time and consume more cognitive resources. The first type of mental activities has been classified as automatic (Shiffrin, Dumais & Schneider, 1981); the second type has been called non-automatic (Hunt, 1978), conscious (Posner & Snyder, 1975), controlled (Shiffrin et al., 1981).

Therefore, this perspective poses that the acquisition of expertise in a domain involves the automaticity of some aspects of the task and the cognitive control over some other aspects (Chi, 2006; Ericsson, 2006). By consequence, both the command of a second language and the acquisition of expertise in translation might involve automaticity and control. What will determine the status of novice vs. expert, in line with the studies available on the issue, is the fluctuation in the balance between automatic and controlled problem-solving processes.

In the realm of psycholinguistics, the construct was applied to the observation of multiple phenomena; Segalowitz (2010) suggest that the concept of automaticity was particularly productive to observe: a) expert performance in a second language, b) the link between automaticity and cognitive control in the L2 acquisition process.

a) As far as the studies on expert performance in the L2 are concerned, the importance of the idea of automaticity was demonstrated by Favreau and Segalowitz (1983). They compared balanced vs. unbalanced bilinguals in a priming + lexical decision task in order to measure the level of automaticity in semantic access as a function of group. The prime always indicated a semantic category (e.g. FRUIT). The target either was a member of the category designed by the prime (e.g. APPLE), an unrelated target (e.g. TABLE) or a non-word. The task consisted in performing the lexical decision task on the targets presented. Participants were trained in the prime- unrelated target association (FRUIT-TABLE).

Favreau and Segalowitz (1983), as Neely (1977), Tweedy, Lapinsky and Schvaneveldt (1977) found that training was responsible for facilitation and inhibition effects in the L2. For example, employing longer ISI between prime and target (1.150 ms), there was in inhibitory effect for unexpected target words (e.g., FRUIT-APPLE after the training in the unrelated prime-target association). This inhibitory effect was interpreted as due to the use of controlled processes: When the prime was presented, participants anticipated the occurrence of an unrelated target that finally was not presented. However, when a shorter ISI was employed (200 ms), there was a facilitation effect in all cases indicating that participants automatically activated all prime-target relationships. Therefore, the study by Favreau and Segalowitz showed the balance between automaticity and control in (balanced) bilinguals.

b) Segalowitz and Frenkiel-Fishman (2005) suggest that another aspect that is fundamental for language learning is the ability to consciously direct attention towards language. This ability is non-automatic and attentional in nature. The authors assumed that selective attention is fundamental for the acquisition of expertise in language learning since it allows individuals to focus on the communication process. Segalowitz and Frenkiel-Fishman (2005), in order to study the role played by controlled mechanisms in L2 learning, employed an attentional switching task adapting the original task by Rogers and Monsell (1995). They assumed that expertise in L2 is closely linked to the degree of control that bilinguals exert over the ability of consciously directing attention towards specific characteristics of language. For this reason, the authors observed the potential correlation existing between 1) the degree of bilingualisms, 2) the ability to shift the attentional focus between different linguistic elements. They employed a switching task based on the presentation of temporal adverbs and conjunctions; these are linguistic elements that are characterized by a strong deictic function, which is, they direct and re-direct the attention of users. When adverbs were presented, participants were asked to define the temporal distance between the adverb and present context. The second task required participants to determine the presence (or absence) of a causal relationship between the sentences connected by the conjunction (e.g., *John passed the exam because he studied all night long*). The adverbs (A) and conjunctions (C) were presented in the following order: "…AACCAACCAACC…", causing the sequence "repetition (R)-change (C)": "…RCRCRCRCRCRC…". The authors observed a close relationship between attentional costs due to switching and the degree of bilingualism shown by participants. Concretely, attentional control predicted the proficiency of bilinguals in their L2. These data are consistent with the study by Bajo and Padilla (2000), who compared untrained vs. trained bilinguals and observed a qualitative advantage in the group of translators, both in reading times and accuracy in processing complex texts for posterior recall; they are also in line with the research developed by Bialystok (2001) on the superiority of some attentional processes in bilinguals.

As indicated for other domain-specific abilities, it is difficult to differentiate automatic and controlled processes underlying second language use, since experts in cognitive control show an enhanced balance between automaticity of already-practiced processes and flexibility needed to produce unpracticed responses. This balance is modulated by the experience and expertise in the allocation of the cognitive resources needed to perform a specific task (in the case of the present thesis, translation task) in an effective way (Ericsson, 2006). What seems not yet totally clear is where the turning point that discriminates between novices and experts in the balance between automaticity and cognitive control is located: possibly, as the bilinguals develop higher cognitive control, they improve their domain-specific skills and automaticity increased as a result; another possibility is that automaticity in lexical retrieval and semantic access allows a better distribution of the cognitive resources and, therefore, a general improvement in the ability of exerting cognitive control.

To our knowledge, there are no studies focusing on the observation of the balance between automaticity and cognitive control as a function of training in translation tasks. Therefore, the key idea of the present thesis is that expertise in professional translation can modulate this balance and, by consequence, the balance might vary as a result of different experiences in bilingualism, both in linguistic and non-linguistic tasks. Our goal in the current research is to explore the balance between automaticity and cognitive control in bilinguals and expert translators.

Cognitive control and bilingualism

According to some authors (i.e., Green & Abutalebi, 2013), handling two or more languages increases the cognitive demands placed on linguistic processing in such a way that linguistic control in enhanced in bilinguals; this would result in an overall enhancement of general cognitive control mechanisms responsible for the performance on non-verbal tasks that require cognitive control, due to the fact that non-linguistic abilities trigger the same control processes needed for linguistic control (Green & Abutalebi, 2013).

Empirical studies developed over the last 20 years suggest that there is an advantage in cognitive control due to bilingualism (e.g., Bialystok, Craik & Luk, 2008; Bialystok, Craik, Klein, & Viswanathan, 2004; Carlson & Meltzoff, 2008; Hernández, Costa, Fuentes, Vivas, & Sebastián-Gallés, 2010, Salvatierra & Rosselli, 2011). However, caution is needed when dealing with the advantages associated to bilingualism (e.g., Hilchey & Klein, 2011; Paap & Greenberg, 2013; Paap & Sawi, 2014), since there are numerous factors that exert an impact on the bilingual advantage, such as Age of Acquisition (AoA) and interaction with the environment (behavioral ecology of bilingual speakers, e.g., Green, 1997, 2011).

However, the great majority of studies on bilingualism suggests the presence of enhanced cognitive control abilities in bilinguals. For example, it was observed that bilingual children are better at performing the Simon task (Morton & Harper, 2007) compared to monolinguals (Baker, Kovelman, Bialystok, & Petitto, 2003; Bialystok, 2006). The same pattern of results has been observed for other executive control tasks, such as the Wisconsin Card Sorting Test (Zelazo, Reznick, & Pinon, 1995), classification tasks (Bialystok, 1999; Bialystok & Martin, 2004, Experiment 1), Piaget's conservation tasks (Bialystok & Majumder, 1998), tasks based on mental rotation of images (Bialystok & Shapero, 2005) and problem solving (Bialystok & Senman, 2004).

Thus, the efficiency in cognitive control processes associated to bilingualism appears early in childhood and is kept active in adulthood and elderly. For example, adults show an important advantage in switching tasks, both in linguistic and non-linguistic domains (Prior & Gollan, 2011). This pattern of results is replicated in various studies and employing a wide range of experimental paradigms. In the Stroop task (Bialystok, Craik, & Luk, 2008; Hernández et al., 2010) and in the Flanker Task (Costa, Hernández, & Sebastian-Gallés, 2008), bilinguals respond better to conflict by ignoring the irrelevant information that compete with the correct response. These tasks provide useful indexes of inhibitory control, that is, of the ability to inhibit non-relevant information in favor of responses that are appropriate for the task. Bilingual individuals also perform more efficiently on basic processes linked to memory and attention. Costa et al. (2008) employed the ANT task, developed by Fan, McCandliss, Sommer, Raz, and Posner (2002), and compared bilinguals vs. monolinguals in alerting, orienting and cognitive control. Bilinguals outperformed monolinguals in alerting and cognitive control, confirming that the linguistic advantage generalizes to high-level processes of cognitive control.

The bilingual advantage is more visible in especially difficult tasks (Bialystok, 2006; Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009). For example, Bialystok (2006) observed that bilinguals outperformed monolinguals when the Simon task was particularly difficult, requiring high degrees of monitoring and task-switching. This pattern of results was confirmed in a study by Costa et al. (2009) in which the Flanker task was employed. The authors manipulated the monitoring load of the task, and compared low-load condition (Experiment 1) vs. high load condition (Experiment 2). The monitoring load was manipulated through different patterns of presentation of congruent and incongruent trials. Differences between monolinguals and bilinguals only emerged when the task involved high-load monitoring. Data suggest that bilingualism has an impact on the monitoring processes involved in executive control and that bilinguals are more efficient in monitoring the cognitive control system to solve the conflict.

This line of research also suggests that the presence of a bilingual advantage and the type of processes in which it appears depends on the type of bilingualism and the task used to catch on this advantage (Green, 2011; Green & Abutalebi, 2013; Morales, Gómez-Ariza, & Bajo, 2013; Morales, Padilla, Gómez-Ariza, & Bajo, 2015). As a consequence, different factors and bilingual experiences have to be considered to observe how the use of two languages modulates cognitive control processes. Green (2011) suggests that bilingual communities differ, since some of them code-switch, while some others do not. The latest speakers are experts in avoiding language conflict. On the other hand, in communities where individuals code-switch language control is different (Green, 1998). Speakers freely take advantage of the joint activation of their languages. Their skill lies less in avoiding language conflict and more in adapting their response to dual language activation. In terms of Abutalebi and Green's (2013) model, it has been shown that the Anterior Cingulate Cortex, left frontal cortex and caudate respond differently to single vs. dual language contexts. In a dual language context (code switching), where participants are required to use both languages in naming simple objects, the three regions get activated (e.g., Abutalebi, Annoni, Zimine, Pegna, Seghier, Lee-Jahnke, Lazeyras, Cappa, & Khateb, 2008). Interestingly, this pattern of activity is absent when participants name the same objects in the L1 context, when no code switching is required. Moreover, caudate activation is particularly sensitive to language switching with no activation observed when the context does not require switching (e.g., Kovelman et al., 2008; Rodriguez-Fornells et al., 2002). Therefore, it seems that the behavioral ecology of individuals shape the neural circuits involved in language control, since differences in code switching impose different demands on cognitive control (Green, 2011).

Differential responses of the control circuits to different language contexts are explained in terms of early and late selection, based on the idea that given joint activation of both languages, bilingual speakers have to resolve language conflict by inhibiting the non-target language at some point (Green, 1986, 1998; Hoshino & Thierry, 2011; Linck, Kroll, & Sunderman, 2009; Macizo, Bajo, Martín, 2010; Philipp & Koch, 2009) or by restricting competition to words within the target language in some other manner (e.g., Costa & Caramazza, 1999; Elston-Güttler, Gunter, Kotz, 2005; Finkbeiner & Caramazza, 2006; see Bialystok, Craik, Green, & Gollan, 2009, for a review). Green (2011) suggests that in a single language context words in the other language are blocked in an early selection stage, mediated by the inferior frontal cortex. By consequence, other structures such as the caudate are not activated. By contrast, in the dual language context, switch trials necessarily require late selection and, in this context, the caudate is also recruited. Response of the circuit is similar to that shown when individuals respond on incongruent trials in the Stroop task (Green, 2011). Here, participants must suppress an incorrect response derived from the written word. Suppressing such interference activates the caudate as well as frontal regions (Ali, Green, Kherif, Devlin, & Price, 2010).

In other words, bilingualism is not a categorical variable (Luk & Bialystok, 2013), since it involves the interaction of language proficiency and environmental context (Bialystok & Hakuta, 1994; Hakuta, Bialystok & Wiley, 2003; Fishman & Cooper, 1969). Bilingual experience is dynamic and several factors do exert an impact on the bilingual advantage. For example, Luk and Bialystok (2013) examined the responses from a questionnaire administered to 110 heterogeneous bilinguals; language use, acquisition history and self-reported proficiency were analyzed. Two correlating factors were extracted, which is, daily bilingual usage and English proficiency. These two factors also correlated with self-rated proficiency in English (L1) and non-English (L2) language. Results were interpreted by the authors as supporting the notion that bilingual experience is composed of multiple related dimensions that need to be taken into consideration in the assessments of the consequences of bilingualism, since each of the many experiences bilinguals face on a daily basis uniquely influences the functioning of cognitive control mechanisms.

Cognitive control and translation expertise

If researchers embrace the idea that in order to account for the complexity of bilingualism several factors need to be considered, such as the behavioral ecology of bilingualism and AoA, further studies are needed to explore the translation task in terms of the differences in cognitive control between trained and untrained bilinguals.

Yudes, Macizo, and Bajo (2011b), for example, hypothesized that professional translators and bilinguals would show advantages in different components of cognitive control. In their study, professional translators outperformed bilinguals on the Wisconsin card sorting test. This task requires participants to infer a categorization rule; the rule changes across trials in such a way that participants need to constantly change the inferred rule. In the case of translators, fewer trials were needed to infer the norm and fewer errors were committed overall. Interestingly, professionals committed less perseveration errors, which is, they showed higher degree of cognitive flexibility when they were required to change the hypothesis linked to the rule. Overall, this study suggests enhanced cognitive flexibility due to professional expertise.

In a very recent study, Morales et al. (2015) compared interpreters vs. non-interpreters in the ANTI-V task; they showed that expertise in translation transfers to other domains, and that this transfer is related to the cognitive processes triggered to perform the translation task (Working Memory, alert and orienting of Attentional networks). These data are in line with *The Adaptive Control Hypothesis* by Green and Abutalebi (2013) that poses that recurrent use of the executive processes for the monitoring of dual language activation and selection of the relevant language changes the functioning of the computational mechanisms required for the task. The pattern observed perfectly matches the main characteristics of the translation task since, from the attentional point of view, translation requires alert in order to process the input and orienting to re-direct the attentional focus towards the production phase in a flexible manner (Cowan, 2000; Yudes, Macizo, & Bajo, 2011b).

In sum, the aforementioned studies clearly show that different experiences in bilingualism and specific training in translation differentially modulate the functioning of the general cognitive control mechanisms needed to be, on the one hand, an efficient translator and, on the other, a functional bilingual.

THE SPECIFICITY OF TRANSLATION EXPERTISE IN BILINGUAL EXPERTISE

In the previous paragraphs it was extensively shown that bilingualism is not a categorical variable; conversely, bilingualism results from the interaction of different factors, such as language proficiency and L2 usage in the environment, is dynamic in nature and there are several variables that do exert an impact on the bilingual advantage. By consequence, translation expertise has to be taken into account and compared to other forms of bilingualism.

The Psycholinguistic perspective: how to differentiate sub-components and cognitive processes

Dillinger (1994) was a pioneer in the study of the comparison between bilinguals and translators in the experimental domain; in a psycholinguistic study on comprehension during the translation process, he claimed that the differences between the two groups were due to a more efficient use of the cognitive resources by translators.

However, this initial perspective was followed by a large amount of studies that attempted to determine what components and cognitive processes vary as a consequence of professional expertise in translation.

Translation is an extremely complex communicational event based on the interplay of quite a variety of linguistic control processes (lexical and semantic access, syntactic processing), cognitive control processes (Yudes et al., 2011a, 2011b) that depend on working memory capacity (Signorelli et al., 2011), divided attention (Gile, 1997, 1999, 2001; MacWhinney, 2005), coordination to switch between languages (Christoffels & de Groot, 2004; Gile, 1991, 1997), and on the effective allocation of the cognitive resources recruited to properly attend the various aspects of the translation process (Gile, 1995, 1997, 2008).

For this reason, many cognitive studies attempt to disentangle the particular processes and components that are responsible for the differences associated to training in translation relative to other forms of bilingualism.

Comprehension Processes

In one of his studies, Dillinger (1994) observed the functioning of different sub-components of the comprehension process (e.g. syntactic processing, syntactic formulation, micro-textual processing and macro-textual processing). He compared very experienced professional interpreters with untrained English/French bilinguals who never translated or interpreted. He measured the accuracy of performance during the interpreting task. Overall, Dillinger detected quantitative differences between the two groups, since interpreters were able to correctly translate a higher amount of text (17% more) compared to bilinguals. However, no qualitative differences were observed between the two groups as a function of the four variables considered, suggesting that both groups analyzed texts in a similar manner and that the differences were due to an enhanced ability, by interpreters, to select the semantically-to-be-processed information, showing an enriched cognitive flexibility in comprehension processes and enhanced linguistic abilities.

However, when different sub-components associated to linguistic comprehension are considered independently and systematically, differences between the two groups (professionals and bilinguals) do emerge. For example, Bajo et al. (2000) compared professional interpreters, untrained bilinguals, L2 students and professionals specialized in other domains in a comprehension task focused on the individual words comprised in sentences which were presented through the moving window paradigm. The groups did not show differences in accuracy; however, reading times differed as a function of group, suggesting that the processing for comprehension, overall, is more efficient in the group of interpreters. Bajo et al. (2000) also compared trained and untrained bilinguals in lexical and semantic retrieval, employing a lexical decision task and a categorization task. Professionals outperformed bilinguals in both tasks, showing faster access both to lexical forms and semantic information.

At this point, it might be asked how the differences observed between trained and untrained bilinguals in comprehension tasks are explained. There are different lines of research that address this question. The differences between the two groups seem to be due to (a) specific linguistic processes (e.g. lexical and semantic access); the ability shown by translators to (b) process linguistic material in a parallel manner (under divided attention conditions), (c) coordinate different sub-components of the translation task, (d) monitor efficiently the execution of the linguistic processes they set in motion.

Working Memory and Divided Attention

Several publications have appeared in recent years documenting that working memory (WM) plays a central role in professional translation (e.g., Christoffels & de Groot, 2003; Christoffels et al., 2006; Gile, 1997; Liu, Schallert & Carroll, 2004).

Consider, for example, the study by Christoffels and de Groot (2003); they administered to untrained bilinguals a simultaneous interpreting (SI) task; they also measured lexical retrieval through a translation task and a picture naming task, respectively. Working memory (WM) span was measured by reading and digit span tasks. The authors found a high correlation between WM span, retrieval of translation equivalents and performance in SI. These data show that the efficient use of WM and retrieval of translation equivalents are very important abilities underlying performance in SI. Similarly, Christoffels et al. (2006) compared professional interpreters, bilingual students and English teachers in linguistic (word translation and picture naming) and memory tasks (word and reading span). Again, interpreters outperformed bilinguals in lexical retrieval and working memory capacity.

There are studies in which the link between performance in linguistic tasks and working memory has been explored systematically. Padilla, Bajo, and Macizo (2005) observed that interpreters succeeded in maintaining higher levels of divided attention, which is, cognitive control over linguistic tasks. Participants performed a memory task in which they had to memorize a list of words for subsequent recall. Simultaneously, an articulatory suppression task was employed, in such a way that participants had to perform a dual task in 50% of trials. The interaction Group x Articulatory Suppression was significant; interpreters' performance stood out in the dual task condition relative to the control group. Therefore, the superior performance observed in the group of interpreters in comprehension, lexical and semantic retrieval tasks might be due the general and more efficient allocation of cognitive resources under dual task conditions.

Padilla et al. (2005) also replicated the absence of the articulatory suppression effect when they compared professional interpreters vs. a control group, matched in WM; thus, the absence of the effect in interpreters is not only due to their superior working memory capacity. The authors claimed that the professionals' skill of computing and retrieve simultaneously the information while they utter the previously processed message might be due to their better use of cognitive resources, and the ability to coordinate the several sub-processes that are executed in parallel.

In a second experiment, Padilla et al. (2005) employed a double task condition introducing a visual/ spatial secondary task. No between-groups differences were observed; by consequence, the authors supposed that the absence of the articulatory suppression effect in interpreters was not due to the general ability of maintaining divided attention between various tasks or processes, but to some kind of ability more closely related to the simultaneous comprehension and production, such as semantic or lexical access to knowledge. This hypothesis was tested in their last experiment, in which the familiarity of the linguistic material was manipulated; the idea was that the articulatory suppression effect would be observed in the case of low familiar material (non-words). This was exactly what the authors observed, confirming that familiarity of the linguistic material at hand is fundamental for the functioning of the phonological WM and the superior capacity of interpreters in coordinating linguistic tasks.

The data mentioned so far suggest that, as Gile claims (1995, 1997), the better use of the co-activation of the SL and TL in professional translators might be due to the ability to divide attention between the different linguistic components of the translation task: input processing, output retrieval, and uttering of the output previously processed. Therefore, it seems that the superior professionals' performance while performing the translation task is a direct consequence of the efficient monitoring of the various sub-processes underlying the translation task.

Coordination of linguistic sub-processes

As suggested above, recent studies have shown that professional translators, compared to untrained bilinguals, coordinate in a more efficient way the various sub-processes associated to the translation task, such as the source language comprehension together with the activation of the lexical items in the target language.

Macizo and Bajo (2006, Experiment 2) asked professional translators to translate orally some visually presented sentences. Sentences were presented in Spanish and translated into English. The cognate status of words was manipulated (e.g., *piano*). They reasoned that if participants accessed to the lexical and semantic forms in the target language before they completed the comprehension phase in the source language, facilitation would have been observed for cognate words compared to controls. Results confirmed the initial prediction. Reading times in response to cognate words were faster compared to controls. Moreover, the facilitation effect for cognate words only was observed in reading for translation; the effect was not observed in reading for repetition, which indicates that lexical processing is modulated by the task performed.

Ruiz, Paredes, Macizo, and Bajo (2008, Experiment 1) confirmed these results employing the same procedure. In their study, the frequency of critical words was manipulated in the target language. In reading for translation, high-frequency words were processed more rapidly compared to low frequency, despite being matched in frequency in the source language. Again, the effect was observed only in reading for translation. Therefore, when professionals perform translation tasks, they coordinate efficiently the simultaneous source language comprehension and target language lexical retrieval. At this point, we might ask about the possible differences in how they coordinate these processes depending on the professional experience in translation.

Ibáñez, Macizo, and Bajo (2010) asked bilinguals and professional translators (equated in L2 proficiency) to read sentences in Spanish or English;

sentences were presented word-by-word through a self-paced reading paradigm. Language of presentation switched randomly across trials. This was the first critical manipulation, since it allowed observing the inhibition of the language not in use through the measurement of the cost associated to language switch as a function of the directionality of translation (L1 towards L2 or L2 towards L1). Concretely, the asymmetrical switching cost (larger cost when switching to L1 relative to switches towards the L2) is considered an index of inhibition: strong inhibition is applied to the dominant L1 when participants process in L2. Thus, additional time is required to overcome inhibition when returning to L1. The authors also manipulated the cognate status of some words. This type of manipulation is also critical since it offers an index of the co-activation of the bilingual's languages (Dijkstra, Grainger, & van Heuven, 1999; Kroll & Stewart, 1994; Macizo & Bajo, 2006). A processing advantage was observed for cognate words in the case of professional translators, indicating that both languages were maintained active during the reading process. Moreover, translators did not show an inhibitory pattern, since they did not show asymmetrical switching cost. Bilinguals, however, showed a higher cost while switching from the L2 to the L1 than vice versa; this indicates that bilinguals do inhibit the language they are not using to perform the task. Additionally, no facilitation effect was observed for cognates in bilinguals, suggesting that only the language in use was active while performing the task.

In all, different experiences in bilinguals caused differences in language activation and in the functioning of linguistic control: translators maintained their two languages equally active and did not show inhibition of the language not in use. These results demonstrate that differences exist in the manner translators and bilinguals coordinate the sub-processes involved in the translation task.

Monitoring of linguistic processes

Finally, we wanted to mention a recent study indicating that professional translators exhibit a more efficient use of metalinguistic and cognitive control-related abilities during comprehension.

Yudes et al. (2011b) compared monolinguals vs. different types of bilinguals (untrained bilinguals, translation students and professional translators) in text comprehension. Participants were asked to detect lexical and semantic errors while reading and comprehending a text. Professionals outperformed the other groups in the error detection task. Therefore, this pioneer study suggests that professionals are characterized by especially efficient metalinguistic abilities (knowledge about how the comprehension phase has to be carried out) and monitoring skills (revision of lexical and syntactic forms) during reading and comprehension.

Different experiences in bilingualism: L2 Age of Acquisition

As previously mentioned, the current assumption is to consider bilingualism not as a categorical variable, but as a dynamic concept that embraces very diverse ecologies of bilingualism. On these grounds, it is fundamental to consider the role played by Age of Acquisition (AoA) of a second language in the cognitive architecture of bilingual individuals.

On the other hand, as we mentioned earlier in this section, from the translatological point of view, some authors argue that expertise in translation depends on managing L2 in a very proficient manner, which would be more likely to show up in early relative to late bilinguals (i.e., DeKeyser, 2000; Johnson & Newport, 1989). In our empirical section we directly assess possible differences between early vs. late bilinguals while performing language tasks. Nevertheless, before that, we offer a brief review of the existing literature on the role of age of acquisition in the L2.

It has been widely documented that one of the most reliable and robust predictor of second language (L2) neural activity and outcome is Age of Acquisition (AoA) (see Birdsong, 2006 for an overview). AoA influences neural activity in phonology (Frenck-Mestre, Anton, Roth, Vaid, & Viallet, 2005), grammaticality judgment tasks (Hernandez, Kotz, & Hofmann, 2007; Waldron & Hernandez, 2013; Wartenburger et al., 2003), lexical access (Mahendra, Plante, Magloire, Milman, & Trouard, 2003; Perani et al., 2003) and syntactic processing (Mahendra et al., 2003).

In an fMRI study by Wartenburger et al. (2003), for example, early and late bilinguals (matched in proficiency) were compared in a syntactic grammaticality judgment task. The authors manipulated the grammaticality of sentences through the use of correct sentences, semantic and syntactic violations. It was shown that syntactic grammaticality judgments performed in the L2 by late high proficient bilinguals resulted in a higher level of activation in the Broca's area, compared to the early bilinguals. More specifically, it was observed that syntactic violations caused a prominent activation in the late bilingual group. The authors concluded that AoA exerts a considerable impact on syntactic processing in bilinguals.

Saur, Baumgaertner, Moehring, Büchel, Bonnesen, Rose, and Meisel (2009) hypothesized that the influence of AoA would be more pronounced for L2 sentences whose canonical word order is infrequent in the L1 (verb-subject sentences vs. subject-verb sentences). They compared early vs. late French/ German bilinguals, matched in proficiency. Participants were asked to judge whether the sentences presented were correct or incorrect. The late bilingual group showed higher activation during grammatical processing in their L2, in brain areas associated to syntactic processing (left inferior and middle frontal gyrus, left inferior temporal gyrus and basal ganglia). This study confirmed the compelling effect of AoA on syntactic processing.

In another study, Hernandez, Hoffman, and Kotz (2007) compared early and late bilinguals in the processing of irregular syntactic forms; the authors manipulated the agreement of the nouns comprised in the sentences presented to participants (in Spanish) and asked to make decisions about the correctness of the nouns' agreement. The two groups showed different patterns of neural activation, being the neural activity of late bilinguals higher in the Broca area while processing syntactic forms whose nouns' agreement was not correct.

Wei, Joshi, Zhang, Mei, Manis, He, Lu, et al. (2015) applied morphometric measurement of specific brain areas using fMRI to observe brain structural variations due to AoA. The authors observed that the bilingual brain is sensitive to AoA in the right angular gyrus and right superior parietal lobe; the earlier the AoA, the larger the volume of these two brain regions. However, they also showed that the later the AoA, the larger the volume of the right inferior frontal gyrus. To sum up, fMRI studies widely report that AoA is one of the most influencing factors of neural organization in bilingual language processing.

On the other hand, as reported in the previous section, continuous control of the two languages by the bilingual leads to the enhancement of general cognitive control mechanisms which are not language specific (Abutalebi & Green, 2007; Green, 1998; Kroll, 2008; van Heuven, Schriefers, Dijkstra, & Hagoort, 2008). Practice is responsible for the linguistic mechanisms to generalize to other cognitive domains (Bialystok, Craik, Green, & Gollan, 2009; Festman, Rodriguez-Fornells, & Münte et al., 2010; Ye & Zhou, 2009).

Most studies showing cognitive advantage in bilinguals have involved participants who learnt their two languages early in life (Tao, Marzecová, Taft, Asanowicz, & Wodniecka, 2011); however, recently, it has been suggested that different experiences in bilingualism (and AoA) might cause differences in the use of executive functions (Luk, De Sa, & Bialystok, 2011). Tao et al. (2011) tested early and late bilinguals employing the Lateralized Attention Network Test (LANT), which provides an index for the efficiency of the alerting network. They assumed that if practice in monitoring and switching between languages from an early age is fundamental for the attentional enhancement to manifest, then the bilingual advantage might not be observed in late bilinguals. The authors found that AoA is fundamental for the monitoring advantage to be detected, since the RT advantage associated to bilingualism only emerged in the group of early bilinguals. In other words, it seems that AoA plays a fundamental role in the enhancing of monitoring processes.

Luk et al. (2011) compared monolinguals, early and late bilinguals in the Flanker task, which is, an executive control task. The authors found that AoA correlated positively with the Flanker effect; the effect was smaller in the case of early bilinguals, being the early group more efficient in suppressing conflicting information and stronger in the maintenance of cognitive control over the task.

Therefore, the evidence seems to suggest that AoA is one of the most influencing factors of bilingual neural organization and linguistic behavior. This idea is tested in one of the studies of the experimental series, in which early and late bilinguals will be compared both in linguistic and non-linguistic tasks.

AVAILABILITY OF COGNITIVE RESOURCES AND AUTOMATICITY IN LINGUISTIC TASKS

Modulation of the co-activation between Source Language and Target Language

From a cognitive viewpoint, the interpreting activity involves, at least, three basic processes: (a) Source language (SL) comprehension (analysis of lexical units, syntactic processing and comprehension of the utterances' meaning), (b) code switching or reformulation between the two languages involved in the task at hand, (c) linguistic production in the Target language (TL) (e.g., Gerver 1976; Lambert 1992; Padilla et al., 1995). An important concern of cognitive studies on interpreting and translation has been to understand how the comprehension, processing and production mechanisms work together as an all-in-one process in translators and interpreters, and how they interact on a temporal basis.

Before we aspire to understand how different experiences in bilingualism influence the allocation of cognitive resources while processing language materials for translation, we should consider the manner in which professionals handle one of the most relevant issues related to the translation activity, which is, the interference due to cross-linguistic co-activation. Professionals, in fact, are extensively trained to avoid the transfer of the source language's patterns when these are not relevant in the target language, since this would cause interference between the two languages.

Several studies in the cognitive field indicate that translators access the TL lexical/semantic items before they complete the SL processing. In other words, even in those cases in which only one language is being used, both languages are simultaneously active and interact during comprehension for translation (Macizo & Bajo 2006; Ruiz et al., 2008). This dual activation of candidates for the output production phase forces towards the selection of an alternative, both in comprehension and production. The dual activation has also been observed in untrained bilinguals (Blumenfeld & Marian, 2007; Colomé, 2001; Dijkstra, 2005; Hoshino & Thierry, 2011; Ju & Luce, 2004; Kroll & Stewart, 1994; Macizo, Bajo, & Martín, 2010; Spivey & Marian, 1999).

In our opinion, the co-activation of languages is responsible for the enhanced cognitive control ability shown by bilinguals and translators relative to monolingual individuals; the cognitive demands imposed by bilingualism and translation are higher than those imposed by monolingualism, resulting in the triggering of control processes that allow the cognitive behavior to be maintained in line with the communicative goals imposed by the interactional context (Botvinick, Cohen, & Carter, 2004).

On the other hand, it has been widely demonstrated that bilinguals and translators differ as to the manner in which they approach the cross-linguistic co-activation (Ibáñez et al., 2010); bilinguals inhibit the language which is not in use (Ibáñez et al., 2010; Bialystok, 2001), while translators do not employ inhibition mechanisms; actually, they maintain both languages equally active while performing the translation task (Ibáñez et al., 2010; Macizo & Bajo 2006; Grosjean, 2008). Moreover, as far as lexical processing is concerned, previous research confirms that translators access the TL translation equivalents before they complete the SL comprehension process; importantly, they also display the ability to keep their two languages separated, since cross-language interference is considered as an index of low quality interpreting and translation; in other words, they need to monitor the input and output mechanisms in a way that allows them to input the source language and output the target language only (Grosjean 1997). Nevertheless, the input component of both the source and target language is activated, since lexical and semantic TL features are retrieved during SL reading.

When the linguistic processes that are intrinsically related to the syntactic processing of complex sentences are considered, one of the most important studies on the issue is by Ruiz et al. (2008, Experiment 2). In this study, the authors were interested in showing that bilinguals processed syntactic rules (e.g., noun- adjective standard order in a sentence) while performing the translation task. A group of translators read sentences either for repetition in Spanish or translation into English. On this occasion, the authors manipulated the congruency in word order between the SL and the TL. In congruent sentences, the adjective was presented before the modified noun, and the subject always preceded the verb of the relative clause (e.g., *la bonita casa que yo alquilé este verano tenía un verde jardín*). This Spanish structure is congruent with the syntactic form used in English (note that, in English, adjectives always appear before the noun and the subject tends to accompany the verb, e.g., *The nice house that I rent this summer had a green garden*). In contrast, in incongruent sentences, the necessary TL relation between the adjective-noun and the subject-verb forms was not presented; e.g., *la casa bonita que alquilé este verano tenía un jardín verde*). The results of the study indicated that while performing the interpreting task, participants did actually read faster the congruent sentences than the incongruent ones, that is, they comprehended faster the input information when there was a match between the syntactic structures of the two languages involved in the interpreting process; however, no differences were observed when reading for repetition. The same pattern of results was observed when the interpreters read sentences in their second language (L2, English) for later translation into the L1 (Spanish). Congruent syntactic sentences were read faster than incongruent sentences suggesting that participants activated syntactic knowledge of the target language during the reading of the to-be-translated sentences (Paredes, 2011).

In sum, it seems that professional translators co-activate their languages. More specifically, the facilitation effect found between languages in syntactic processing confirms that both languages are simultaneously active during the task (Hartsuiker et al. 2004); additionally, translators are able to keep them separated (they do avoid interference). The facilitation effect also shows that the professionals retrieve the syntactic structure of the TL for production before they complete the comprehension process in the SL; namely, they employ the input and output mechanisms simultaneously but independently one from the other, modulating their level of activation even at the syntactic level.

One of the main goals of the current doctoral thesis is to further comprehend the functioning of the SL input and TL output mechanisms which underlie syntactic processing in translation by observing processing differences in the resolution of syntactic ambiguities when the task changes from a monolingual to a bilingual mode.

Processing of ambiguous relative clauses and handling of the cross-linguistic co-activation

The observation of the manner in which professionals solve syntactic ambiguities while performing the translation task allows analyses of the L1 and L2 processes underlying task performance. It has been shown that cross-linguistic comprehension of ambiguous relative sentences is language specific (Carreiras 1992; Carreiras & Clifton 1999; Gilboy, Sopena, Clifton, & Fraizer 1995). In sentences like *Someone shot the servant of the actress who was on the balcony* there are two antecedents, "servant" and "actress", and both are potential correct agents of the clause "was on the balcony".

In line with the late closure principle proposed by the *Garden path theory* by Frazier (Frazier 1978; Frazier & Rayner 1982), it has been observed that native English speakers adopt a low attachment strategy to solve the ambiguity. According to this strategy, new elements (the relative clause) are attached to the noun phrase currently being processed, the most recent one (*the actress*). However, previous research consistently showed the existence of cross-linguistic differences in relative clause attachment (Carreiras & Clifton 1999; Gilboy et al. 1995), through the use of different experimental procedures, such as post-process evaluation (asking questions on the agent e.g., *Who was on the balcony?*) or on-line comprehension measures (reading times, Cuetos & Mitchell 1988). Many researchers report that native speakers of Spanish prefer to identify as agent of the relative clause (*was on the balcony*) the first antecedent of the sentence (*servant*), employing a high attachment strategy (Carreiras & Clifton 1999). Interestingly, unlike monolinguals, bilinguals do not show any attachment preference when processing ambiguous clauses (Dussias, 2001; Fernández, 2003).

Fernández (2003) evaluated the attachment preference in English monolinguals and Spanish-English bilinguals. All participants were first asked to read complex predicative sentences which included relative clauses similar to those mentioned (*Someone shot the servant of the actress who was on the balcony*) and, secondly, to answer a question to determine the preferred agent of the relative clause (e.g., who was on the balcony?). The aim of this task was to assess whether participants used a high attachment strategy, as Spanish monolinguals did (the servant was on the balcony) or, instead, they used a low attachment strategy, which is common in English monolinguals (the actress was on the balcony). As expected, native English monolinguals preferred a low attachment strategy (73%). By contrast, English-Spanish bilinguals did not show a clear preference towards either high or low attachment. These participants opted for low attachment in 49% and high attachment in 51% of the clauses presented. Similarly, Dussias (2001) evaluated a group of English monolinguals and English-Spanish bilinguals. All participants were instructed to first read predicative sentences in English and, secondly, to answer an agent attachment questionnaire. Data showed that English native speakers preferred low attachment in 86% of cases. However, the selection of the preferred attachment in English (low) was reduced to 56% in the case of English-Spanish bilinguals. The fact that bilinguals do not show any clear attachment preference seems to suggest that their two languages are simultaneously activated and influence each other so that syntactic processing preferences in one language change under influence from the other language.

Theoretical models that explain the cross-linguistic co-activation in bilinguals. As previously mentioned, one of the main goals of the present thesis is to evaluate how cross-linguistic co-activation is negotiated by professional translators; to reach our goal we will exploit the observation of how they process syntactic structures that are ambiguous cross-linguistically.

The two psycholinguistic theoretical models that frame our research on syntactic processing by translatorsare the Grosjean's *Language Mode Theory* (1997; 2001; 2013) and MacWhinney's *Competition Model* (1992). According to Grosjean, the relative activation of the two languages would depend on the linguistic context. Thus, even a bilingual may adopt a monolingual mode when the context requires the use of only one language. In contrast, when interpreters perform their task both the SL (the one heard) and the TL (the one spoken) are active because both are needed, for comprehension and production respectively (Grosjean, 2013). Thus, the model would predict that the resolution of syntactic ambiguities in our experiment might differ depending on whether the task to be performed involves one (reading for repetition) or two languages (reading for translation). On the other hand, according to MacWhinney's competition model, proficiency in L2 leads to the development of new strategies that can be flexibly used to reduce interference from the L1. When the language user moves towards the mastering of the L2, he/she attempts to restructure the L2 in such a way as to avoid reliance and transfer from L1. As the beginner learners become experts, they develop a series of strategies that will allow the use of direct L2 strategies instead of transferred L1 to L2 strategies, since "if the target forms are passed through an L1 filter, the learner will never be able to detect a mismatch between one's own forms and the correct target forms" (MacWhinney, 1992: 6). Both models stress the idea that expert users of language are able to detect the mismatch between their L1 and L2 (MacWhinney, 1992) and remap their L2 linguistic approach avoiding interference. In order to do this, users modulate their cognitive behaviour (input and output mechanisms) according to the requirements of the task they may want to perform (Grosjean, 2013), adopting the TL preferred strategies (MacWhinney, 1992).

Idiomatic Processing

As mentioned above, previous studies indicate that one of the most important skills in translation is the retrieval of translation equivalents (Christoffels at al., 2003; Christoffels et al., 2006; Gerver, 1976; Macizo & Bajo, 2006; Paradis, 1994). The establishment of direct cross-linguistic connections between translation equivalents is very plausible (Christoffels & de Groot, 2006), especially in the case of multi-word language chunks, such as phrasal verbs, collocations, idioms, formulas, sayings. This idea, moreover, is consistent with the observations about expertise developed in the problem solving literature, that support the idea that experts store their knowledge in chunks (fragments).

Multi-word expressions are an effective tool for the study of *chunking* (both in the L1, the L2 and in L1-L2 translation tasks). The storage of translation solutions by chunks would imply, firstly, the storage in memory of multi-word forms as holistic structures in the L1 (e.g., *Better to be alone than in ill company*). Secondly, it would imply the same holistic storage in the L2 (e.g., *Mejor sólo que mal acompañado*), and a direct connection between the two holistic units.

De Groot and Christoffels (2006) suggest that the continuous occurrence of such linguistic units in the two languages of bilinguals create direct associations between translation equivalents in memory. The research we carry out in the present thesis about this issue is based on the assumption that, in the specific case of professionals, each translation event would strengthen the link (the memory trace) between the equivalents. The more frequent the co-occurrence of translation equivalents, the stronger the memory connection between them (de Groot & Christoffels, 2006).

Paradis (1994) claims that expert translators exploit this direct route between equivalents more rapidly compared to untrained bilinguals or less experienced translators. By consequence, due to professional practice, expert translators should allocate fewer cognitive resources to retrieve (multi-word) translation equivalents between languages; moreover, this process should run in a more automatic way (faster and more efficiently, Segalowitz et al., 2005), due to a qualitative change in the functioning of the computational processes underlying the retrieval of the matching. Throughout the next pages, we will develop a comprehensive analysis of idiomatic processing, focusing on the conceptual definition, theoretical frameworks and empirical data emerged first in the monolingual, then in bilingual literature.

Definition of idiom and its usefulness in the study of basic cognitive processes

Idiomatic expressions (e.g., *hit the road*) are multiword conventional expressions whose semantic meaning cannot be derived from the comprehension of the individual words comprised in the sentence (Cacciari & Tabossi, 1988). These expressions are very common in natural language: one-third to one-half of language is based on idiomatic expressions (Erman & Warren, 2000). In the realm of psycholinguistics and linguistics, idioms have received a fair amount of attention; it has been investigated how idiomatic expressions are processed and represented both in the speakers' first (L1) and second language (L2) lexicons.

The idiomatic advantage. Empirical studies have shown the very robust finding that idioms are processed more quickly than non-idiomatic matched literal expressions by native speakers (Conklin & Schmitt, 2012; Tabossi, Fanari, & Wolf, 2009). Along similar lines, there are many studies showing quantitative differences between the processing of idiomatic vs. non-idiomatic expressions in the bilingual domain, with idiomatic language enjoying a processing advantage over non-idiomatic language. This advantage has been observed through reaction time tasks (e.g. Conklin & Schmitt, 2008; Jiang & Nekrasova, 2007; Wolter & Gyllstad, 2011; Wolter & Gyllstad, 2013; Wolter & Yamashita, 2014; Yamashita & Jiang, 2010), self-paced reading (Cieślicka, 2011; Conklin & Schmitt, 2008) cued-recall tasks (Yeganehjoo & Yap, 2009; Yeganehjoo, Yap, Abdullah, & Tan, 2012), divided visual field paradigm (Cieślicka, 2013; Cieślicka & Heredia, 2011), cross-modal paradigm (Cieślicka, 2006, 2013) and eye movement recordings (Heredia, Olivares, & Cieślicka, 2014; Siyanova-Chanturia, 2013; Siyanova-Chanturia, Conklin, & Schmitt, 2011; Siyanova-Chanturia, Conklin, & van Heuven, 2011; Underwood, Schmitt, & Galpin, 2004).

Namely, bilinguals seem to access idiomatic meanings as fast as native speakers. Conklin and Schmitt (2008), for example, performed a reading experiment employing a self-paced moving window technique in which they compared monolinguals vs. balanced bilinguals in comprehension of idioms embedded in high-biasing short stories. The paragraphs biased either towards the literal or the figurative interpretation of idiomatic sentences. Idioms were read faster than literal sentences, both in the native and bilingual group. Since no between-group differences were detected, the authors concluded that bilingual speakers are able to reach the same advantages in idiom processing than those shown by native speakers.

Jiang and Nekrasova (2007) compared English native speakers and Chinese- English bilinguals in a phrase grammaticality judgment task in which they asked participants to make decisions on the correctness of sentences (idiom vs. control). Both groups showed the idiomatic processing advantage indicating that bilingual speakers do reach the same degree of idiomatic sensitivity as that shown by native speakers.

Models of idiomatic processing in monolinguals

Several theoretical models has bee developed in an attempt to explain the idiomatic advantage, both in comprehension and production. The most important theoretical models can be grouped into three main approaches: non-compositional, compositional and hybrid models of idiomatic processing.

Non-compositional models of idiomatic processing. Non-compositional models of idiomatic processing assume that idiomatic expressions are independent lexical entries stored in memory as a whole. This idea implies that the figurative meaning of idioms is not directly related to the literal meaning of its individual components. Some of the most representative models included in the non-compositional approach are the *literal processing model* (Bobrow & Bell, 1973), the *lexical representation model* (Swinney & Cutler, 1979), and the *direct access model* (Gibbs, 1980, 2002). Although these models differ as to the way and the timing according to which the meaning of idioms would presumably be retrieved, they all support the claim that the overall idiomatic meaning is semantically independent from the individual semantic meanings of its components (Caillies & Butcher, 2007). According to this approach, the processing advantage of idiomatic expressions is explained as due to their entity as single lexical units that are directly accessed.

Compositional models of idiomatic processing. Compositional models propose that idioms vary in terms of their compositionality (The *Phrase-Induced Polysemy Model* by Glucksberg, 2001, 2003; the *Literal Salience Resonance Model* by Cieślicka, 2004). These models share the assumption that the individual meanings of the idiom's components do contribute to the construction of the figurative interpretation of the string. As a consequence, these models reject the idea of holistic retrieval from memory of a lexicalized, pre-fabricated sequence and assume that idiom processing requires on-line semantic and syntactic analyses of the individual components (e.g., Cacciari & Glucksberg, 1991; Cacciari & Tabossi, 1988, 2014; Cieślicka, 2006; Glucksberg, Brown, & McGlone, 1993; Titone & Connine, 1999).

The *Configuration Hypothesis* (Cacciari & Tabossi, 1988), for example, assumes a distributed representation of idioms in the mental lexicon. The main premise of this view is that the idiom is associated to a specific network of words, which are the same that get activated in literal on-line processing. Upon encountering an idiom, the phrase is processed literally until the *idiom key* is reached in the sequence and accessed in the mental lexicon (the idiom key is the word of the idiom that triggers its figurative meaning) (Cacciari & Tabossi, 1988). Only at this point, the individual words included in the idiom are recognized as part of an idiomatic network and the idiomatic meaning is retrieved. According to these models, the repeated use of idioms would be responsible for a higher associative strength between the individual lexical nodes that form the idiom; as a consequence, the advantage shown during the processing of idiomatic expressions would depend on whether these connections are created, allowing a direct retrieval of the idiomatic meaning from the lexicon (Cieślicka, 2006).

Evidence for the compositional models of idiomatic processing comes from the demonstration that compositionality (that is, the degree to which the individual word meanings contribute to the overall figurative meaning) plays a fundamental role in the comprehension of idiomatic expressions.

Gibbs and Nayak (1989), for example, showed that adults took more time to decide that non-decomposable idioms were semantically acceptable compared to decomposable idioms. According to Glucksberg (2001) the facilitation effect observed in comprehension of decomposable idioms is due to the overlap between the result of the on-line literal analysis and the overall figurative meaning; on the other hand, for non-decomposable idioms, the literal analysis does not match the figurative meaning, causing a slowing down of the whole process.

Hybrid models of idioms processing. In between compositional and non-compositional models of idioms processing, the hybrid approach assumes that idioms are both compositional and non-compositional (Titone & Connine, 1999). According to these models, the retrieval of the figurative interpretation arises when a sufficient part of the idiom has been processed literally, until the idiomatic key is reached (similarly to what the Configuration Hypothesis suggests). Thus, the idiomatic key triggers the figurative meaning, whose processing runs in parallel with the literal analysis of the string. This is the main difference between Titone and Connine's Hybrid Model and the Configuration Hypothesis: the former assumes that the literal computation of the idiom is maintained even after the figurative meaning has been retrieved. In the same vein, Cutting and Bock (1997) claimed that although idioms are stored and represented as a whole, they cannot be word-like entries without internal structure.

As claimed in Sprenger, Levelt, and Kempen (2006) hybrid models share the core assumption that idioms are unitary in the sense that they require their own lexical-conceptual entry, and compositional because activation spreads towards the individual lemmas comprised in the idiom; these individual lemmas function as a network when inserted in an idiom, but their functioning is not restricted to it (Sprenger et al., 2006). A recent version of the hybrid models that can be applied both to production and comprehension is the *Superlemma Model* (Sprenger et al., 2006). The superlemma is the holistic and unitary representation of the idiom at the syntactic level, which includes the individual lemmas forming the idiom and their syntactic properties. It is connected both to the idiom's unitary lexical concept as well as to the simple lemmas (the individual components). In this approach, upon encountering an idiom such as *kick the bucket* for comprehension, the lemmas associated to each individual word would be activated twice, by the on-line processing compositional route and as part of the superlemma (non-compositional route) (Carrol & Conklin, 2014). This clearly provides an advantage over the processing of non-idiomatic expressions, which can be processed only via the activation of the lemmas associated to each individual word of the literal expression. However, the activation of the figurative meaning of *kick the bucket* still requires the selection of the superlemma over the activation of the simple lemmas. The superlemma *kick the bucket* (that contains the syntactic constraints that come along with the idiom) competes with the single lemmas "kick = punt" and "bucket = pail" and other related and potentially active superlemmas, such as "meet your maker". According to Sprenger et al., in this competition between co-activated lemmas, the probability of selecting the target superlemma at the lemma level and its underlying concept (at the conceptual level) "is the ratio of the superlemma's degree of activation and the total activation of all lemmas in the lexicon" (Sprenger et al., 2006: 177). At this point, the idiom is recognized as such if its superlemma's activation rises above a certain critical threshold. According to the model, the level of activation of the superlemma will depend on the degree of exposure to it and on the degree of overlapping between the meanings of the individual lemmas and the superlemma.

Hybrid models of idiomatic processing in bilinguals

There is a rapidly growing literature on the application of the hybrid account to the bilingual idiomatic processing.

Carroll and Conklin (2014), for example, observed that Chinese-English bilinguals were faster to perform a lexical decision task in their L2 (English) when a target word (i.e., *feet*) was preceded by the initial words of a Chinese transliterated idiom (*draw a snake and add…*, which does not make any sense in English) compared to a target matched control word (*hair*). They explained this pattern by assuming that the initial words of a transliterated Chinese idiom activate the unitary concept of the idiom, which is shared across the bilingual's languages. This concept spreads activation both to its lexical and syntactic properties (designed as the superlemma in Sprenger et al., 2006) and to the individual components, making the lexical form of the target (feet) available in the L1 or directly in the L2 (if a sufficiently strong connection has been created across languages). Since the L1 form is a translation equivalent of the target presented, facilitation for the English word "feet" is observed in whatever way.

Yeganehjoo and Yap (2009) explored the hybrid models of idiomatic processing in bilinguals. Interestingly, their results suggest that -similar to other studies with monolinguals- idioms seem to be represented both compositionally and non-compositionally in the bilingual L2 mental lexicon. In their study, they found priming effects in the production of both idiomatic (*hit the sack*) and literal sentences (*move the sack*) when primed with one of their constituents (*sack*; identity prime), confirming that the lemmas composing the idiom can be accessed individually. Moreover, the effect of the identity prime was more evident in the case of idiomatic expressions compared to their literal controls, suggesting that the idiomatic expressions are stored and represented as memorized lexical chunks even in the L2 mental lexicon.

Yeganehjoo et al. (2012) also confirmed that idioms are stored as chunks, and that linguistic expertise strengthens the connection between the L2 idiom and the underlying concept, establishing a direct access route for the processing and retrieval of idiomaticity in the L2.

Therefore, when both languages are called into play, for example in translation tasks or when bilinguals are immersed in a language switching context, performance will depend on the degree of idiomatic cross-linguistic exposure (both in the L1 and L2) and the overlapping/ matching (congruency) between the L1 and L2 idiomatic forms. As an example, in order to rapidly and efficiently translate the idiom *Kick the bucket,* the following should happen: once the L1 superlemma (*Kick the bucket*) has received activation to a degree that rises above the activation received by the individual lemmas comprised in the idiom "kick=punt" and "bucket=pail", allowing the figurative meaning's retrieval, the L2 translation equivalent, *Estirar la pata*, also would require a level of activation that rises above the single nodes' level of activation, which is, "Kick=patear" and "bucket=cubo".

More concretely, the literature based on the hybrid approach stresses the importance of two main factors that presumably modulate bilingual idiomatic processing, which are coherent with the observations shared in monolingual studies (Sprenger et al., 2006; Titone & Connine, 1999): the experience in the bilingual use of the idioms and idiomatic congruency between languages. This last remark is fundamental for the main goal of the present thesis, since both congruency and linguistic experience will be studied here, through direct manipulation.

Bilingual experience and idiomatic processing. As mentioned above, the hybrid approach proposes that idiomatic access to the superlemma depends, on the one hand, on the degree of exposure to the idiomatic form. There are studies that took into account this issue (e.g. Yeganehjoo et al., 2012). In an eye-tracking study, Siyanova-Chanturia, Conklin, and van Heuven (2011) compared the processing of idiomatic sequences embedded in sentences with different phrasal frequency (for example, *bride & groom* vs. *groom & bride*). The authors compared native, low and high proficient bilinguals. More proficient bilinguals and native speakers read more frequent idiomatic binomials significantly faster than the reversed forms; on the other hand, less proficient non-native speakers showed no differences in reading speeds for the two phrase types. These results suggest that different types of exposure (low vs. increased exposure) to the linguistic input modulate the processing advantage observed for idiomatic processing; namely, through increased exposure, learners represent in memory not only the lexical items comprised in the idiom, but the idiom as a whole (Siyanova-Chanturia et al., 2011; Yeganehjoo & Yap, 2009); this holistic representation (defined as the *Superlemma* by Sprenger et al. 2006) fluctuates as a consequence of different types of exposure to the bilingual experience.

In another study, Siyanova and Schmitt (2007) explored the influence of exposure to L2 environments on learners' idiomatic competence based on the idea that successful acquisition of prefabricated language requires prolonged L2 natural exposure (Dörnyei et al., 2004; Schmitt et al., 2004). They compared groups with different degree of exposure to the L2-speaking environment (no exposure vs. less than 12 months exposure vs. more than 12 months exposure), employing a knowledge judgment task. They asked participants to rate their knowledge of the idiomatic forms presented throughout the experiment. Significant differences between the exposure vs. no exposure groups were observed; moreover, there was a significant correlation between the time spent in the L2 environment and the knowledge of idiomatic language, suggesting that increased L2 exposure leads to better knowledge of idiomaticity.

In conclusion, on the basis of the literature currently available, it has been shown that highly proficient bilinguals show the same idiomatic advantage displayed by native speakers; moreover, the increased sensitivity to idiomaticity seems to be a direct consequence of increased exposure to the L2 natural environment.

Cross-linguistic idiomatic congruency. In bilingual idiomatic processing, the influence that the L1 exerts over the L2 can cause facilitation at times or the need for control mechanisms to act over interference at other times (Wolter, 2006; Wolter & Gyllstad, 2013). It has already been observed that idioms vary along a continuum of language specificity, in the sense that idioms in one language may not have a totally overlapping translation equivalent consisting of identical lexical nodes in another language: the same concept may be expressed by identical or totally different lexical items cross-linguistically (Yamashita & Jiang, 2010).

Based on the degree of between-language overlap of lexical items, idioms can be classified as congruent or incongruent. Congruent idioms are idiomatic expressions whose word-by-word translation is felicitous (i.e., *to break someone's heart* = *romperle el corazón a alguien,* in English and Spanish, respectively). On the contrary, incongruent idioms are expressions whose word-by-word translation is not feasible (i.e., the English idiom *To kick the bucket* and its Spanish translation *Estirar la pata,* whose literal meaning is *To stretch one's leg*).

It is important to stress that, according to hybrid models, the cross-linguistic overlap between the individual constituents and the superlemma representing the idiomatic expression is crucial for predicting a processing advantage in idiomatic vs. non-idiomatic expressions (i.e., Bortfeld, 2003; Caillies & Butcher, 2007; Gibbs & Nayak, 1989). In other words, in the case of congruent idioms (i.e., the English form "you broke my heart" and the Spanish translation equivalent "me rompiste el corazón") the translation would be facilitated, since the individual lexical entries of the idiomatic expressions are shared across languages (break = romper, heart = corazón), along with the idiomatic meaning of the sentence (you hurt me). In contrast, when an English incongruent idiom (*kick the bucket*) has to be translated into Spanish (*estirar la pata*), the idiomatic meaning (to die) would foster the activation of the proper, idiomatic lexical entries in Spanish (estirar, pata) which would compete with those associated to the translation of the independent, literal lexical units of the English idiom (kick = patear, bucket = cubo). Therefore, the advantage in idiomatic processing relative to literal language would be weaker when incongruent vs. congruent idioms are considered. Consequently, the cross-linguistic correspondence between the lexical items comprised in the idiom can cause either facilitation or interference (Wolter, 2006). Facilitation is likely to occur for congruent idioms, while interference plausibly might occur for incongruent idioms. In support of these predictions, there is empirical evidence showing that the facilitation effect associated to the processing of idiomatic expressions in bilinguals depends on the congruency between the L1 and the L2 (Wolter & Gyllstad, 2011, 2013; Wolter & Yamashita, 2014).

To illustrate, Wolter and Gyllstad (2011) presented a verb prime to English native speakers and Swedish/English (L1/L2) bilinguals and observed whether it was more likely to facilitate recognition of a noun target if the resulting verb + noun idiomatic form was congruent (i.e., *to join club*) versus incongruent (i.e., *to throw party*) between the two languages considered. Significantly faster reaction times (RTs) were observed to target words that were primed with words that formed congruent and incongruent idioms relative to a baseline condition. However, the processing of congruent idiomatic expressions was faster relative to the processing of incongruent expressions. Thus, idiomatic processing depends on the similarity of these expressions across languages (for other congruency effects in bilingual comprehension and production of idioms, see Irujo, 1986, 1993; Wolter & Gyllstad, 2013; Yamashita & Jiang, 2010)

In production, Irujo (1986) employed a translation task and found that English idioms that were comprehended and produced most correctly by Spanish learners of English were congruent between languages. As far as the translation of idioms is concerned, to our knowledge, the only research that has explored this issue is the one by Irujo (1986, 1993). Forty-five paragraphs in Spanish were employed, each containing an idiom. Idiomatic similarity between languages was manipulated: fifteen idioms had identical English equivalents, some others were similar in form and the rest were totally different. Irujo (1993) required participants to translate the paragraphs from Spanish to English. It was found that congruent idioms were easier to translate compared to incongruent idioms, providing further evidence that proficient speakers of a second language use their first language to produce idioms, and that the degree of similarity to first language idioms might be the most important factor influencing transfer during the translation process. It was also observed that when idioms were not produced, the most common substitute was a literal synonym or paraphrase.

In comprehension, Wolter and Gyllstad (2013) and Yamashita and Jiang (2010) compared native speakers and proficient bilinguals in an acceptability judgment task in English. Their finding were similar; congruency did not have an effect on native speakers' performance; however, bilinguals uniformly judged congruent idiomatic expressions as acceptable more quickly than incongruent expression.

Wolter and Gyllstad (2011) argued that one plausible explanation for the accelerated recognition of congruent forms was due to the parallel activation of the same patterns (translation equivalents) cross-linguistically. They also claim that the general facilitation effect observed when bilinguals process congruent idioms whose figurative meaning and word-by-word translation is congruent between languages is in line with the hybrid models of idiomatic processing (e.g., Sprenger et al., 2006; Titone & Connine, 1994) and more general models on lexical and semantic selection (e.g., *Revised Hierarchical Model* by Kroll & Stewart, 1994).

Yamashita and Jiang (2010) employed a phrase-acceptability judgment task to compare native speakers of English and bilinguals (Japanese/ English) on English congruent and incongruent idiomatic expressions; they analyzed accuracy and reaction times. They manipulated the degree of exposure to the L2 (high vs. low exposure). It was observed that the low exposure bilingual group took longer and made more errors when they responded to incongruent collocations; even though the high exposure group also made more errors on incongruent idioms, they showed no difference in reaction time between congruent and incongruent idiomatic expressions. In other words, the congruency effect shown by the highly competent group suggests that it is more difficult to promote in the L2 lexicon a semantic representation for incongruent idioms, since they require higher exposure to the L2. These data indicate that even highly competent bilinguals might continue on depending on the L1 lexicon filter, at least for incongruent idiom processing, as envisioned in previous theoretical frameworks (i.e., The Revised Hierarchical Model, by Kroll & Stewart, 1994).

Yeganehjoo et al. (2012) also investigated the impact of cross-linguistic similarities on the representation and production of L2 idioms (English) by Iranian bilinguals. They employed a primed cued-recall task in which they asked participants to memorize congruent English idioms. Then, four types of critical prime words were presented auditory for the cued-recall task: L1 and L2 shared concept, L1 and L2 related lexical unit, L1 related lexical unit, the idiom key and finally, unrelated controls. At the same time, a prompt word (the grammatical subject of the idiomatic expression) appeared on the computer screen and the participants responded uttering the corresponding English idioms. They measured the lag between the simultaneous visual presentation of the prompt word plus the auditory presentation of the prime and the production phase. The results indicated that L1 and L2 shared concept was a weak input to trigger the production of the L2 idiom, suggesting that the link between the concept and the L2 idiom was weak: delayed RTs were observed because of the use of the less direct route, which was lexically mediated through L1. In fact, the L1 (Persian) related lexical primes had the strongest effect on the production of the L2 idiom, because despite being unrelated to the L2 idioms, the primes were related to the Persian counterpart, so that they activated the configuration of the L1 idioms and allowed mediation via the L1 translation equivalent to produce the L2 idiom.

The findings on bilingual idiomatic processing discussed so far confirm the influence exerted by the L1 over L2 processing, an issue that has been well demonstrated in the literature (Kroll & Stewart, 1994; Sunderman & Kroll, 2006; Talamas, Kroll, & Dufour, 1999). Additionally, they share the core assumption that, through increased exposure to the L2, direct links between the L2 superlemmas and the conceptual store are created, in such a way that L2 idioms are progressively processed more and more independently from the L1 lexicon (conceptually-driven processing). The overall results suggest that the acquisition of L2 idiomatic forms is a process that takes a long time, and both L1 congruency and the amount of L2 input interactively affect the acquisition.

The novelty of the research we did in the present doctoral thesis lies in that, to our knowledge, this is the first study that attempt to investigate the potential link existing between idiomatic processing, the allocation of the cognitive resources recruited in both linguistic and non-linguistic tasks and the fluctuations caused by different behavioral ecologies.

If summary, previous research focusing on bilingual idiomatic processing confirm the co-activation of the bilingual's languages even in those contexts in which only one language is being used; this increases the cognitive demands imposed on control processes. Our working hypothesis in the current thesis was that different experiences in bilingualism will differentially modulate the strength of the associations established between the lemmas and the superlemmas, both in the L1 and L2, and the allocation of the cognitive resources needed to handle idiomatic forms cross-linguistically.

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CHAPTER II

MAIN GOALS OF THE PRESENT STUDY

The main purpose of the present section is to itemize the main goals and sub-goals underlying the research interest of our study. Goals are presented at the light of the theoretical frameworks explored so far. Clear references to the chapters comprised in the present work (III to VI) are provided, in order to facilitate overall reading.

The present doctoral thesis aimed at evaluating the balance between automaticity and cognitive control as a function of different types of bilingualism. We do not assume bilingualism as a categorical variable. Instead, several bilingual experiences can be considered based on the interaction of language proficiency and language use in the environment. Therefore, in the research section we evaluate bilinguals with professional experience in translation, untrained bilinguals, and we also compare fluent bilinguals with different L2 age of acquisition. The balance between automaticity and cognitive control is addressed firstly in a broad non-linguistic domain and afterwards, we move to the linguistic field by studying the co-activation of languages at the syntactic level and during the processing of idiomatic expressions. The main goal described in this paragraph is detailed in the following specific goals.

GOAL ①: BALANCE BETWEEN AUTOMATICITY AND COGNITIVE CONTROL

As we discussed in the previous chapter, it is worth exploring the balance between automaticity and cognitive control in bilingual expertise. The importance of investigating this issue stems from the data supporting the view that language experts show both enhanced automaticity and high degrees of cognitive control when they perform bilingual tasks (Bialystok, 2001; Bialystok, Craik, Klein & Viswanathan, 2004; Segalowitz & Frenkiel-Fishman, 2005; Segalowitz, Segalowitz, & Wood, 1998; Taube-Schiff & Segalowitz, 2005; Slobin, 1996).

This point is fundamental to detail the first goal of the present study, since we aimed at exploring the nature (automatic or controlled) of the attentional response produced by monolinguals, untrained bilinguals and professional translators in a memory search task whose memory load was manipulated across trials (Schneider & Shiffrin, 1977; Wolfe, 1994; Wolfe, Brunelli, Rubinstein, & Horowitz, 2013). This task has been extensively used to study the difference between automatic and controlled processing and in this context, can be a useful tool to explore the balance between automaticity and control as a function of different language experiences. In a memory search task, a set of characters (letters), called the Memory Set, is presented to participants to memorize the stimuli and the Memory-set Size is varied. In the second part of the trial, participants are presented with a sequence of rapid frames containing letters, and asked to search for the possible occurrence of any of the elements included in the Memory Set. Schneider and Shiffrin observed that RT was dependent on the Memory-set Size during the first block of trials, in such a way that RTs increased proportionally to the number of letters included in the set. Although there is some controversy about the condition in which search is dependent on memory load (see Wolfe, 1994), this Memory-set Size effect is usually interpreted as due to the serial and controlled nature of the memory search process. Their results also showed that after many trials of consistent practice (memory search was constrained to a fixed set of letters that never appeared as distractors) the Memory-set Size effect decreased, revealing that the searching process had been automatized. In other words, this procedure and the Memory-set Size manipulation in this task allow us to explore the capacity to automatize the memory search and to restructure the cognitive resources underlying the task.

The degree to which the Memory-set Size effect is present indicates that the memory search is being carried out maintaining cognitive control; in contrast, the effect disappears when the search has been automatized and, consequently, when the overall process consumes fewer attentional resources.

In the present study, our aim was twofold: on the one hand, we wanted to investigate eventual differences between monolinguals and bilinguals in a task tapping non-linguistic processes. If it is certain that bilingualism alters the cognitive behavior in response to a specific linguistic experience, differences should be observed between monolinguals and bilinguals. On the other hand, we also aimed at comparing bilingual and professional performance, in order to observe whether the balance between automaticity and cognitive control is modulated by different behavioral ecologies (for a definition of behavioral ecology, see Green, 2001), here, trained vs. untrained bilingualism. The first goal of the current study is explored in Chapter III.

GOAL ②: BILINGUAL EXPERTISE AND LINGUISTIC SUB-SKILLS

Sub-goal (A): Source and Target Language co-activation in syntactic ambiguity resolution

The second goal of the present research was to explore the functioning of the activation of the source language and target language mechanisms in interpreters at the syntactic level (Chapters IV- VI). Namely, as far as sub-goal (a) of goal 2 is concerned, we focused on how professionals solve syntactic ambiguity when performing the interpreting task. It has been shown that cross-linguistic differences exist when comprehending ambiguous relative sentences (Carreiras 1992; Carreiras & Clifton 1999; Gilboy, Sopena, Clifton, & Fraizer 1995) and that either source or target language strategies can be adopted to solve the ambiguity (e.g., low attachment strategy is more frequent in English while high attachment strategy is preferred in Spanish). However, data show that bilinguals do not prefer any clear language-related strategy to solve the ambiguity. This suggests that their two languages are simultaneously activated and influence each other, in such a way that syntactic processing preferences in one language change under the influence of the other language.

In order to operationalize the ideas posed in the second part of the introduction (Chapter I) we adapted the procedure previously employed by Macizo and Bajo (2006) to the analysis of ambiguous clauses. Participants were asked to read sentences either for repetition or subsequent translation. After performing the task, interpreters were instructed to answer verification questions about the possible agent of the sentences; this revealed the attachment strategy they employed while performing the task.

Our goal was to observe the professional translators' behaviour as a function of task; in fact, in the reading-for-repetition task, translators might either behave as monolinguals and show the attachment preferences related to their L1 (monolingual mode) or, alternatively, similar to bilinguals in previous studies (Fernández, 2003), they might not show any clear attachment preferences. Nevertheless, in the reading-for-translation task, the predictions made about ambiguity resolution were clear: in this case, participants would activate the TL at the syntactic level while reading in the SL and, hence, they would use the syntactic strategies preferred in the TL to disambiguate the SL sentences. In fact, the ability to silence SL characteristics while translating into the TL is assumed to be part of translation expertise; it guarantees the translation task to be carried out rapidly and efficiently. Moreover, this ability requires efficiency in the allocation of cognitive control resources (Christoffels, de Groot, & Kroll, 2006; Gile, 1997; Green, 1998) and should be clearly detectable in expert translators 'performance.

Sub-goal (B): Expertise in translation and Idiomatic processing

In the introductory section it was extensively reported that one of the most important abilities underlying efficient translation performance is lexical retrieval of translation equivalents (Christoffels, de Groot & Waldorp, 2003; Christoffels et al., 2006; Gerver, 1976; Macizo & Bajo, 2006; Paradis, 1994). The presence of direct connections between translation equivalents is quite plausible (De Groot & Christoffels, 2006), especially in the case of multi-word fragments such as collocations, idioms, sayings. In order to explore the availability of cognitive resources while accessing translation equivalents as a function of different experiences in bilingualism, we employed a reading for translation task and embedded a dual task condition in the comprehension phase (detection of a tone presented auditory). It is worth reminding that the basic idea underlying the use of the tone detection methodology is that the more cognitive resources are needed to process the idiomatic expression, the fewer resources would be left for processing the tone. Idioms were employed as a tool to explore the degree of automaticity in retrieval of translation equivalents, due to their functioning as lexicalized, chunked units (Tremblay & Baayen, 2009; Wray, 2005) that would result in a processing advantage for idioms relative to literal sentences (Gibbs, 1980; McGlone, Glucksberg, & Cacciari, 1994; Swinney & Cutler, 1979).

Moreover, in order to isolate the retrieval processes that typify professional performance in translation, different types of bilinguals were compared: professional translators, untrained bilinguals, and bilinguals characterized by different Ages of Acquisition of the L2 (early vs. late bilinguals).

The consensus view on translation expertise seems to be that professional translators are consistently trained to access lexical information, both in the L1 and L2, in a relatively more automatic manner (Padilla, Macizo, & Bajo, 2007). Translation training allows comprehension and retrieval processes to be more rapid and efficient (automatic) (Christoffels et al., 2006) and better performance in translation tasks is related to faster RTs both in lexical retrieval and word translation tasks (Christoffels et al., 2003).

Consequently, we first aimed at observing whether, due to their training in lexical retrieval, translators would exhibit stronger connections between the nodes (the single lemmas) comprised in the whole idiomatic network (the superlemma, i.e. Sprenger, Levelt, & Kempen, 2006) relative to untrained bilinguals (Chapter V); if this was the case, they would need fewer resources (as measured by performance in a secondary task) in processing idiomatic expressions for comprehension. In addition, they will show better performance in producing and translating these idiomatic expressions. The observation of an enhanced retrieval pattern for, on the one hand, the match between the SL idiom and the underlying concept (comprehension phase) and, on the other, the concept and the TL idiomatic form (production phase) would confirm that training in translation is responsible for automaticity in cross-linguistic idiom's retrieval.

Moreover, we also aimed at testing the impact that cross-linguistic congruency exerts over bilingual idiomatic processing. For this reason, besides manipulating the behavioral ecology of bilingualism, we also manipulated idiomatic congruency between languages. The main difference between congruent and incongruent idioms lies in that congruent idioms can be translated word-by-word, while incongruent idioms require transposition (for a definition of transposition, see Jakobson, 1959). Our goal was to show a processing advantage for congruent idioms, resulting from cross-linguistic transfer and the use of fewer cognitive resources during the processing-for-translation of this type of idioms. However, we were particularly interested in the observable between-group differences in the allocation of the cognitive resources needed to process incongruent idioms; incongruent idioms are more difficult to establish in the L2 mental lexicon and even high proficient, late bilinguals seem to be dependent on L1 mediation for the processing and translation of these idioms.

Since it has been demonstrated that the processing of congruent idioms (whose individual lemmas overlap cross-linguistically) is faster and more automatic relative to incongruent idioms (Wolter & Gyllstad, 2011), between-group differences between trained and untrained bilinguals should be more evident for idioms whose processing is more demanding (incongruent idioms).

Sub-goal (C): AoA and Idiomatic processing

We were also interested in exploring how cognitive control mechanisms responsible for the monitoring and retrieval of competing translation equivalents evolve as a consequence of the demands imposed by different Ages of Acquisition (Chapter VI). The literature suggests that one of the most reliable and robust predictors of second language neural activity and outcome is Age of

Acquisition (AoA) (see Birdsong, 2006 for an overview); AoA is also responsible for significant differences in the use of executive functions (Luk, De Sa, & Bialystok, 2011; Tao et al., 2011): different bilingual experiences exert a varying influence not only on the processes involved in linguistic control but also on the general cognitive control abilities involved in non-linguistic tasks tapping such control (Green & Abutalebi, 2013). Luk et al. (2011) compared monolinguals, early and late bilinguals on the Flanker task (an executive control task) and found that AoA correlated positively with the Flanker effect: the effect was smaller in the case of early bilinguals, being the early group more efficient in suppressing conflicting information and stronger in the maintenance of cognitive control over the task.

On the basis of the evidence currently available, we aimed at comparing bilinguals with different L2 AoA on idiomatic processing and tried to shed some light on the possible link between AoA, idiomatic processing and executive control functions. Namely, it was inferred that the demands imposed by bilingual idiomatic processing might vary as a consequence of AoA (The exposure effect). Moreover, as in sub-goal (b), the cross-linguistic correspondence between the lexical items comprised in the L1/ L2 idioms was considered (the congruency effect), since it has been shown that congruency is particularly relevant for the degree of influence exerted by the L1 idiom over the corresponding L2 idiom and the functioning of the cognitive control mechanisms that negotiate L1/L2 co-activation. As in the previous comparison, we were interested in observing an overall idiom superiority effect in the case of congruent idioms, and plausible between-group differences in the processing of incongruent idioms. We aimed at showing that early bilinguals would display more direct connections between the L2 superlemmas and the underlying concepts, being in this group the L2 idiomatic processing more independent from the L1, relative to late bilinguals.

In order to detect in a straightforward way the eventual correlation between the allocation of the cognitive resources recruited by idiomatic processing (linguistic skills) and general executive functions, participants were asked to perform the idiom comprehension and translation task previously described plus the Flanker Task (Luk et al., 2011). We assumed that longer and more consistent exposure to the L2 natural environment would be associated to a cognitive control advantage (as in Luk et al., 2011) and that this advantage would correlate with performance in the processing of incongruent idioms.

In summary, in the next few chapters we empirically address these questions. The results and general conclusion of these empirical studies are summarized and discussed in Chapter VII of the thesis.

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CHAPTER III

AUTOMATIC AND CONTROLLED PROCESSES IN TRANSLATION AND BILINGUALISM

In the present study, we focused on automatic and controlled processes in translation expertise. We wanted to explore whether expert translators and bilinguals differ in their ability to automatize some skills and in their ability to efficiently use executive control to improve performance. Our interest was to determine whether the balance between automaticity and control differ depending on the type of bilingual experience (untrained bilinguals vs trained professional translators). Monolinguals, bilinguals and professional translators performed a memory search task (Schneider & Shiffrin, 1977). Comparisons between the three groups showed differences both in the automatization and in the pattern of cognitive control. These differences are interpreted in terms of professional practice in translation and every day bilingual practice.

Automaticity and cognitive control in expertise

In the last decade, a large number of studies have provided evidence that specific forms of training and experiences (e.g., play piano, specific upbringing, etc.,) shape how individuals perform in tasks tapping processes related to cognitive control (e.g., Bialystok & Depape, 2009; Hedden, Ketay, Aron, Markus, & Gabrieli, 2008). The use of more than one language appears to be one of the factors that contribute to shape individual performance on these tasks (e.g., Bialystok, Craik, Green, & Gollan, 2009). One of the main reasons why bilinguals might exhibit enhanced cognitive control is due to the fact that they have to coordinate two jointly activated languages in their minds. Evidence from different experimental procedures suggests that bilinguals activate their two languages even when only one is in use (Bialystok et al., 2009; Kroll, Dussias, Bogulski, & Valdés, 2012). Due to this language co-activation, bilinguals continuously need to engage language selection processes to control interference from the unintended language. These processes are assumed to involve attentional resources and to be similar in nature to those involved in conflict resolution in other nonverbal tasks. Hence, the continuous engagement of language selection processes leads to an enhancement of attentional control mechanisms (Bialystok, Craik & Luk, 2012). Thus, the consequences of bilingual experience on cognitive control are clearly visible not only in linguistic but also in non-linguistic tasks, whenever they require executive functions such as inhibition processing (e.g., Bialystok, 2001), monitoring (Costa, Hernández, Costa-Faidella & Sebastian-Gallés, 2009), switching (Prior & Gollan, 2011) working memory (Luo, Craik, Moreno, & Bialystok, 2013; Wodniecka, Craik, Luo & Bialystok, 2010); coordination (Bialystok, 2011), mental flexibility (Peal & Lambert, 1962) and proactive-reactive control adjustment to cope with interference (Colzato, van den Wildenberg, Zmigrod, & Hommel, 2013; Morales, Calvo, & Bialystok, 2013). However, these findings are somewhat controversial, since the replication of the bilingual advantage in executive control failed on some occasions (see, for instance, reviews by Hilchey & Klein, 2011; Kroll & Bialystok, 2013; Paap & Greenberg, 2013). Differences in bilingual experiences have been proposed as one of the reason that might contribute to conflicting findings between studies (Green & Abutalebi, 2013, but see Paap & Greenberg, 20013; Valiant & Valiant, 2014, for other possible reasons). For example, some studies have reported that bilinguals who are accustomed to switch between their languages are more efficient in non-verbal switching tasks than the bilinguals who do not switch (Prior & Gollan, 2011). Similarly, professional translators seem to engage different language selection processes compared to untrained bilinguals (Morales, Padilla, Gómez-Ariza, & Bajo, 2015).

Recently, Green and Abutalebi (2013) have proposed that language control processes adapt according to the recurrent demands of the language context (Adaptive Control Hypothesis). Each of these contexts may require different involvement of the control mechanisms that, in turn, will result in differential modulations on cognitive control dynamics. Following this idea, the main attempt of the present study is to disentangle possible differences between the cognitive mechanisms recruited by trained translators and untrained bilinguals.

Linguistic and non-linguistic cognitive differences between bilinguals and professional translators have been observed thoroughly on a behavioral basis (Bajo, Padilla & Padilla, 2000; Christoffels, de Groot & Kroll, 2006; Christoffels, de Groot, & Waldorp, 2003; De Groot, 2000; Padilla, Bajo & Macizo, 2005; Price, Green, & von Studnitz, 1999; Yudes, Macizo, & Bajo, 2011; Yudes, Macizo, & Bajo, 2012). Research has shown that language control during professional translation differs from language control during other types of bilingual activities in other contexts. Thus, whereas the usual challenge for bilinguals is to reduce the activation of the non-required language, the challenge for translators is to keep their two languages active at a given time. This fact could presumably lead to the engagement of different control processes for each of these bilingual contexts. Empirical data support this idea, showing that interpreters do not employ inhibitory processes to control their languages as most bilinguals seem to do (Ibáñez, Macizo, & Bajo, 2010) and that different control mechanisms are enhanced by professional practice (Morales et al, 2015; Yudes et al., 2012).

Hence, translation seems to modulate different components of the language system, and the data available strengthen the idea that bilingualism and translation reorganize differently the functioning of mental structures in response to a particular linguistic experience. However, all these studies have focused on executive control, and on the mechanisms underlying possible advantages in executive control whereas automatic processing is an important component of linguistic processing (Levelt, 1989). Hence, differently from the approach adopted in previous studies, in the present work we try to shed some light on the type of mental activities referred to as automatic.

There is evidence that automaticity is a necessary step in skill development in a variety of areas, including reading (LaBerge & Samuels, 1974), athletic conditioning (Fisher & Jensen, 1990), and problem-solving in such fields as mathematics (Gagne, 1983), science (Hasselbring, Goin, & Bransford, 1987; Larken, McDermott, Simon, & Simon, 1980), medicine (Elstein, Shulman, & Sprafka, 1978; Fox, 1980), and chess (Chi, Glaser, & Rees, 1982). Similar to other well practiced skills, we assume translation to become gradually less effortful as a consequence of practice, leading to a faster and more efficient performance.

Research on skill acquisition (see Ericsson, 2006) has shown that the balance between automaticity and cognitive control in any given performance shows an initial increase towards cognitive control as the subjects have to reach an acceptable level. As soon as they adapt to the task demands, their behavior can be emitted with less and less attentional control (Ericsson, 2006; Samuels, LaBerge, & Bremer, 1978). At the same time, as the subjects' behavior is automatized, behavior becomes fixated and individuals lose their conscious control over intentionally modifying and changing it. Under these circumstances, further experience will not be associated with any improvement or learning. Consequently, the correlation between the amount of experience and performance will be low for this type of automated activity. In direct contrast, the expert performance continues to improve as a function of more experience and deliberate practice. In fact, the key challenge to reach expertise is to avoid the arrested development associated with automaticity and to acquire cognitive skills to support continued learning and improvement (Ericsson, 2006). Thus, the acquisition of expertise in a specific domain requires the appropriate balance between the automaticity of some aspects of the task and the cognitive control over some others (Chi, 2006; Ericsson, 2006). Along similar lines, the aim of the present research is to identify the differences in the balance between automaticity and cognitive control according to three different language experiences: monolingualism, bilingualism, and training in translation.

Automaticity and language processing in bilinguals.

Studies on L2 language acquisition suggest that automatic processing of some language components is an important step in achieving fluency. Encoding of morphological and grammatical features such as gender and number agreement, verb conjugation, etc., becomes gradually automatic when individuals learn a language (Chambers, 1997).

The development of automatized mechanisms decreases the load imposed on L2 processing; as long as demanding efforts are required to produce accurate morphology, less cognitive resources are available for other planning tasks and this is reflected in disrupted discourse (Chambers, 1997), as these features are processed in an effortless automatic manner, fluency increases with language performance containing longer segments and uninterrupted speech (Bartning, Forsberg, & Hancock, 2009; Towell, Hawkins, & Bazergui, 1996). According to Segalowitz (Segalowitz & Segalowitz, 1993; Segalowitz & Wood 1998; Segalowitz & Lane, 2000) advantages associated to practice and experience in the L2 also include faster lexical decision times, faster rates of speaking and reading, and better ability to process rapid speech.

Automatic language processing has also been proposed as an important component for professional translation. The more the sub-processes underlying the task are automatized, the more resources are available for the processes that require attention and temporary storage of information (de Groot, 2000). The demands imposed by translation tasks are different than those required for untrained uses of language. Gile (1995, 1997) identified three main components –or Efforts- of the translation task: the effort linked to the processing of the input in the Source Language (SL); the short term memory effort, the production effort in the Target Language (TL) and, finally, a Coordination effort, which is needed to handle the other three efforts. The term effort refers to the non-automatic nature of these components. Each effort has specific processing capacity requirements. In order to perform the task efficiently, total capacity requirements should not exceed the total available capacity (Gile 1995, 1997). In order to decrease the processing load imposed by the efforts, translators routinize the computational operations underlying the task in such a way that more cognitive resources are available for the coordination effort to act efficiently over the whole process.

Hence, optimum performance in translation requires a proper balance between automaticity and control. The underlying assumption of the present study is that monolinguals, untrained bilinguals and professional translators might also differ in the balance between automaticity and cognitive control in non-verbal tasks tapping the same mechanisms recruited for language use. This idea stems from the assumption that the computational processes needed to perform a linguistic task adapt to the demands imposed on individuals by different interactional contexts and generalize to other domains recruiting the same processes (e.g., Green & Abutalebi, 2013; Bialystok, 2006; Costa, Hernández, & Sebastian Gallés, 2008).

In order to explore this hypothesis, we compared monolinguals, bilinguals and professional translators in a memory search task (Schneider &

Shiffrin, 1977; Wolfe, 1994; Wolfe, Brunelli, Rubinstein, & Horowitz, 2013). We selected this task because it requires fast access to information in memory and because it has extensively been used to study the transit between controlled and automatic processing. In a memory search task, a set of characters (letters), called the Memory set, was presented to participants to memorize the stimuli. The Memory-set Size varied between 1 and 4 elements. In the second part of the trial, participants were presented with a sequence of rapid frames containing letters, and asked to search for the possible occurrence of any of the elements included in the memory set. Schneider and Shiffrin observed that RT was dependent on the Memory-set Size during the first trials, in such a way that RTs increased proportionally to the number of letters included in the set. Although there is some controversy about the condition in which search is dependent on memory load (see Wolfe, 1994), this Memory-set Size effect is usually interpreted as due to the serial and controlled nature of the memory search process. Their results also showed that after many trials of consistent practice (memory search was constrained to a fixed set of letters that never appeared as distractors) the Memory-set Size effect decreased, revealing that the searching process had been automatized. In other words, this procedure and the Memory-set Size manipulation in this task allow us to explore the capacity to automatize the memory search and to restructure the cognitive resources underlying the task. To the extent that the Memory-set Size effect is present, it can be inferred that the memory search is being carried out with attentional control, whereas drop in the slope relating memory set size and response time would indicate that the search has been automatized.

In addition, in the present study, in order to make sure that the automaticity observed was reflecting an actual cognitive restructuring of the mental processes underlying the task, the coefficient of variation (CV) was calculated as a function of groups at the beginning of the experiment and at the end of the training practice trials (1500 trials). Segalowitz (Segalowitz & Segalowitz, 1993; Segalowitz & Hulstijn, 2009) proposed that the CV captures the fluency of the mental flow that can be distinguished from simple speed of processing; this index ensures that the automaticity observed is not merely due to a speed-up of the mental processes underlying the task, but to a more stable way of doing these processes. Faster performance may, actually, reflect a general speed-up of the processes involved in a task, which does not necessarily imply that these processes are performed in a steady manner. As claimed in Segalowitz and Hulstijn (2009), when faster performance reflects automatic and stable processes, they do have to be accompanied by a reduction in SD. Concretely, an automatic and stable process would be associated to a reduction in SD that is more than proportional to the reduction in RT (Segalowitz, Watson, & Segalowitz, 1995). In the present study, we calculated the CV in order to assess to what extent the cognitive processes underlying the task were performed in an automatic and stable manner due to consistent practice.

Finally, in order to assess between-group differences in attentional control and flexibility, a switch point was inserted in trial 1500, where the letters were switched in the sense that participants had to search in memory for those letters that appeared as distractors in previous trials. We choose this specific point (trial 1500) because Shiffrin and Schneider (1977) found that after 1500 practice trials memory search was already accomplished in an automatic manner. Thus, after the switch point the letters included in the Memory-set of each trial were modified, forcing participants to switch to a new memory set. We expected translators to exhibit higher flexibility levels in attentional control, in such a way that the switch in the stimuli sets employed should affect them to a lesser degree compared to monolinguals. To the extent that the attentional abilities developed by translators are related to their bilingualism, we expected to achieve similar results for the bilingual participants; nevertheless, if translation ability differs from bilingualism, the two groups should show different patterns of results.

METHOD

Participants

Thirty-six participants took part in the experiment (12 in each group: monolinguals, bilinguals, professional translators). Participants were selected according to the following criteria: (a) translators owned a degree in Translation and Interpreting Studies and had a minimum of 3 years' experience as in-house translators; (b) bilinguals had no specific training in translation tasks; (c) a specific combination of languages was not a requisite to participate in the experiment. As to monolinguals, they were psychology student at the University of Granada and Jaen. Bilinguals and translators received a participation payment, whereas monolinguals took part in the experiment in exchange for course credits. Before performing the task, translators and bilinguals filled in a self-rating questionnaire (Macizo & Bajo, 2006; Macizo, Bajo, & Martín, 2010; Martín, Macizo, & Bajo, 2010), in which they had to rate their speech fluency, speech comprehension, writing and reading skills. The questionnaire provided useful information about their language background both in L1 and L2. The two groups did not differ in their L1 and L2 fluency (all p values > .05). Bilinguals and translators were compared on AoA, which is, the age at which they indicated they started to use actively their L2 on a daily basis (Luk, De Sa, & Bialystok, 2011). A one-way ANOVA was performed introducing the Group as factor. The difference between the two groups in AoA was not significant, $F(1, 22) = .05$, $p = .81$, $\eta_p^2 = .002$. The characteristics of participants are reported in Table 1.

Table 1

Characteristics of participants in the study

	Bilinguals	*Translators*
Gender	10 women – 2 men	11 women – 1 man
Mean age	23.66 (2.01)	26.58 (1.44)
L2 AoA (active use daily)	5.5 (5.14)	5.08 (2.96)
Mean experience in translation (years)	0 (0)	5.33 (2.01)
	Language Proficiency Questionnaire	
L1 speech comprehension	10 (0)	10 (0)
L1 writing proficiency	9.75 (0.45)	9.91 (0.28)
L1 speech fluency	9.91 (0.28)	9.91 (0.28)
L1 reading ability	9.83 (0.38)	10 (0)
L2 speech comprehension	9.75 (0.45)	9.25 (0.75)
L2 writing proficiency	9.25 (0.96)	9.16 (0.83)
L2 speech fluency	9.66 (0.43)	9.25 (0.62)
L2 reading ability	9.66 (0.49)	9.41 (0.79)

Note. Mean scores for the self-evaluation questionnaire on L1 and L2 competence. Self-report ratings for L1 and L2 ranged from 1 to 10, being 1 "not fluent" and 10 "very fluent". Standard deviations are reported in brackets. *T*-test analysis did not yield any significant differences between the groups considered (all *p*s > .05).

Design

Three independent variables were manipulated in the present study. First, the number of characters included in the Memory-set (presented before the beginning of each trial); it was 1, 2 or 4. This variable is known as Memory-set Size and was manipulated within subjects. The second variable was the experimental group (monolinguals, bilinguals and professional translators) and was manipulated between subjects. Finally, the third variable was the Segment (initial vs. reversed) and was manipulated within subjects. The basic dependent variables were the mean reaction times (RTs) and the coefficient of variability (CV) of the subjects' responses through the blocks, which were employed as indexes of automaticity.

Materials and Procedure. The experiment material was constructed following the original experiment by Schneider and Shiffrin (1977). As reported in Figure 1, for the first 1500 initial learning trials, two sets of stimuli were created: the first one included the letters belonging to the first part of the alphabet (B, C, D, F, G, H, J, K, L) which served as targets; the stimuli configuring the Memory-set Size of each trial were selected among these items. The second stimuli set, the distractor set, included the letters belonging to the second part of the alphabet (N, P, Q, R, S, T, V, X, Z). The final 300 trials, labeled as reverse learning, presented the reversed target-distractor condition, being "N, P, Q, R, S, T, V, X, Z" the targets, and "B, C, D, F, G, H, J, K, L" the distractors. Both targets and distractors were assigned to trials randomly.

■ *Figure 1.* **Structure of the whole experiment (Adapted from Schneider and Shiffrin, 1977)**

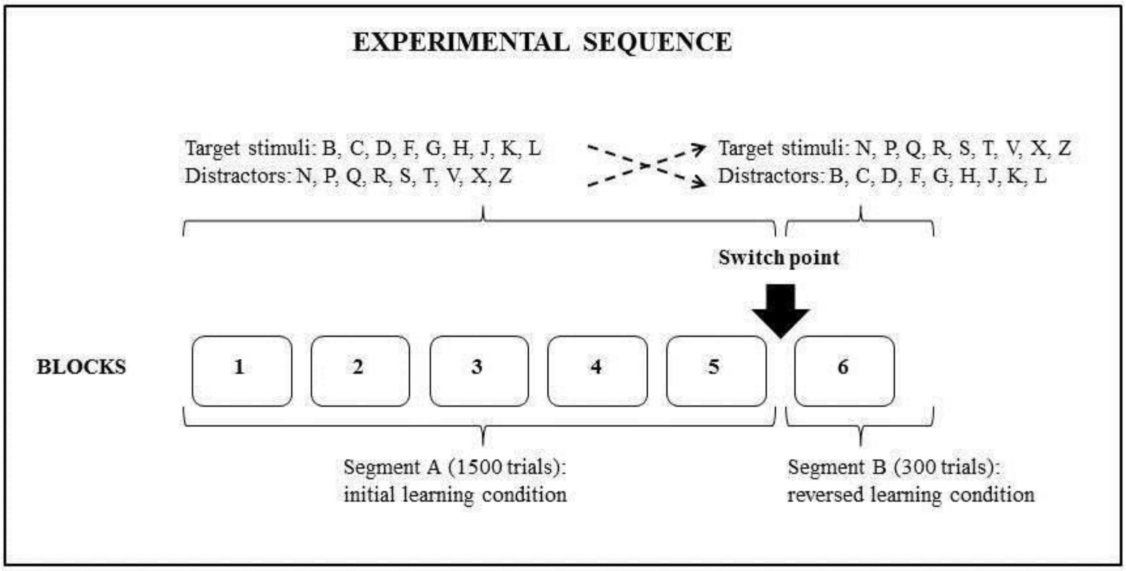

Figure 1. For the first 1500 (Segment A, five blocks) the letters belonging to the first part of the alphabet (B, C, D, F, G, H, J, K, L) were used as targets, while the letters belonging to the second part of the alphabet (N, P, Q, R, S, T, V, X, Z) were employed as distractors. After the switch point, the reversed target-distractor condition was presented (Segment B, one block), being "N, P, Q, R, S, T, V, X, Z" the targets, and "B, C, D, F, G, H, J, K, L" the distractors.

As indicated in Figure 2, a sequence of 20 frames was presented on each trial. Each frame consisted of four elements arranged in a square around a central non-signaled fixation dot. The elements presented could be letters or random dot masks. They were arranged as follows: a) two letters (target and distractor when the target was present or two distractors in the no-target condition along with b) two sets of dot masks (:: ; ::). The position of targets, distractors and dot masks on the square varied randomly throughout trials. The font used was Courier New 36 points; the stimuli box presented the elements on a 6cm distance square. The frame time (the time from the onset of one frame to the onset of the next) was for all, but the first, 2 sec (Schneider & Shiffrin, 1977). The frame time was kept constant over all trials. No item or mask was ever presented in the same display position in two successive frames. Targets appeared randomly in 60% of the trials.

■ *Figure 2.* **Structure of trials**
(Adapted from Schneider and Shiffrin, 1977)

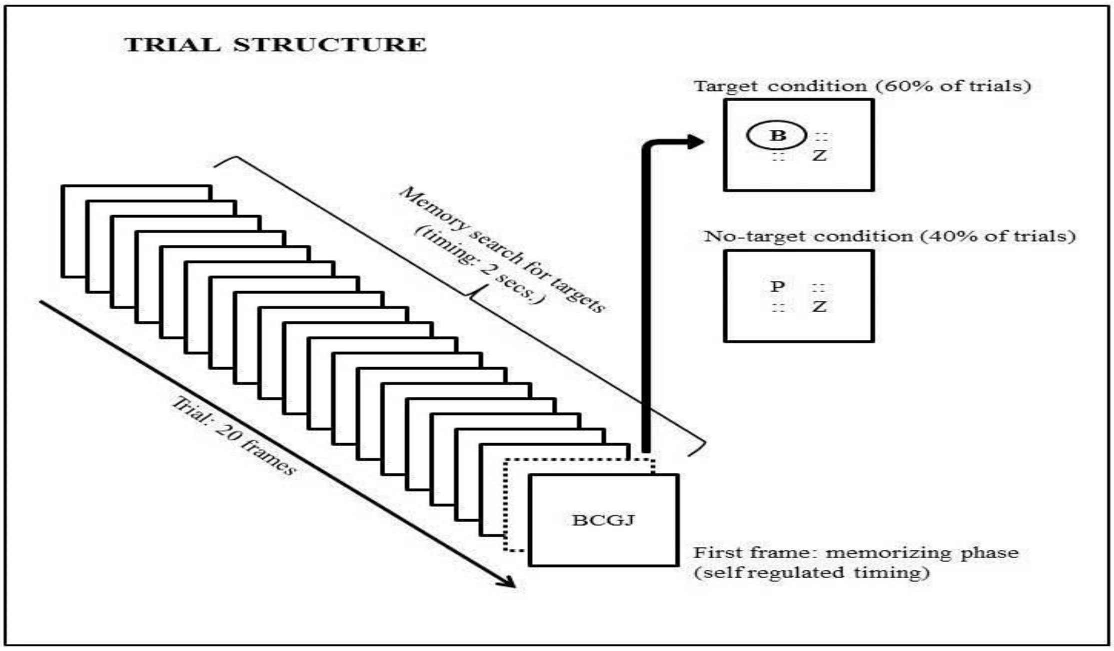

Figure 2. A sequence of 20 frames was presented on each trial. The first frame contained the Memory Set participants had to memorize (1, 2 or 4 elements, arranged in a row). Each following frame consisted of four elements arranged in a square around a central no-signaled fixation dot. The elements presented could be letters or random dot masks. They were ordered as follows: a) two letters (target and distractor when the target was present or two distractors in the non-target condition along with b) two sets of dot masks (:: ; ::). Targets appeared on 60% of trials. The position of targets, distractors and dot masks on the square varied randomly throughout trials.

The experiment was presented on a 17 inch laptop screen using E-prime software (Schneider, Eschman, & Zuccolotto, 2002). Participants seated at 55 cm distance from the screen; their responses were collected through the use of a computer keyboard. Each trial began with the presentation of the Memory-set (memorizing phase). Timing for the memorizing phase was self-paced. Participants entered the following phase (the searching phase) by pushing the space bar. The task consisted on detecting any element of the Memory-set that appeared in the sequence of frames. Participants were encouraged to take frequent breaks and were asked to maintain the highest level of accuracy while performing the task. Overall, they completed 1800 trials attending to 4 experimental sessions; the first three sessions included 500 trials, and lasted 4 hours each; the last one included 300 trials and lasted about three hours; each subject performed a 15 hours task. The first three sessions (segment A) were labeled as initial learning, while the last one (segment B) was defined as reversed learning condition. Between segment A and B a switch condition was presented, reversing the link between target and distractor sets. The two sets were counterbalanced within the groups. Participants were not informed about the switching point inserted between the initial and reverse learning conditions.

RESULTS

The trials were grouped in blocks of 300. The initial five blocks corresponded to the initial learning condition, whereas block 6 was the reverse learning condition. The RT and CV analyses were carried out considering exclusively the correct responses provided by participants (86.03%). We did not perform analysis on accuracy/ error data since the main goal of the present experiment was to evaluate the *directness* of the search-in-memory process (availability of cognitive resources while retrieving the targets) only in those cases in which a correct response was provided by participants.

Practice effect on memory load throughout the experimental task

These analyses focus on the RTs of correct hits in responding to the presence of targets in the memory search task. Since we were interested in the in the change between initial performance (Block 1), performance after extensive practice (Block 5) and performance after the switch Block 6), we directly compare Block 1, 5 and 6. In this way we had the same number of trials in each block facilitating comparisons among the different practice conditions.

Hence, the RTs were first analyzed using a 3 x 3 x 3 mixed design ANOVA with Group (monolinguals vs. bilinguals vs. translators), Memory-Set Size (1 vs. 2 vs. 4 elements) and Block (Initial practice in *Block 1* vs. Final practice in *Block 5* vs. Reversed Learning in *Block 6*) as factors. The three-way interaction Group x Memory-Set Size x Block was significant, $F(8, 132) = 2.41$, $p = .01$, $\eta_p^2 = .12$. This interaction was further analyzed in order to evaluate the effect of the Memory-set Size on the RTs of Monolinguals, Bilinguals and Translators at the beginning of the experiment (*Block 1*), after a huge amount of consistent practice had been carried out (*Block 5*), and after the switching point was introduced to produce the Reversed Learning condition (*Block 6*). Overall RTs for the three groups in response to the targets were also compared.

Block 1 (first 300 trials of the initial learning condition).

RT data were analyzed through a 3 X 3 mixed analysis of variance (ANOVA) with Group (monolinguals, bilinguals and translators) as between factor and Memory-set Size (1, 2, 4 stimuli) as within factor. The analysis yielded a significant main effect for Memory-set Size, $F(2, 66) = 72.95$, $p < .001$, $\eta_p^2 = .68$, and Group, $F(2, 33) = 4.13$, $p = .02$, $\eta_p^2 = .13$. Planned comparisons revealed significant differences between monolinguals and bilinguals, $F(1, 33) = 7.12$, $p < .01$, $\eta^2 = .17$, and between bilinguals and translators, $F(1, 33) = 5.07$, $p = .03$, $\eta^2 = .13$. Differences were not significant between translators and monolinguals, $F < 1$. Nevertheless, the Group x Memory-set Size interaction did not reach significance, $F(4, 66) = 1.59$, $p = .18$, $\eta_p^2 = .08$. In Block 1, Mean RTs (with standard deviations in parenthesis) for monolinguals were: 534.51 ms (29.12) for Memory-set Size 1; 563.71 ms (26.11) for Memory-set Size 2 and 579.03 ms (19.50) for memory-set Size 4. Mean RTs (with standard deviations in parenthesis) for bilinguals were: 501.50 ms (27.44) for Memory-set Size 1; 535.71 ms (28.14) for Memory-set Size 2 and 560.10 ms (19.19) for Memory-set Size 4. For translators, Mean RTs (with standard deviations in parenthesis) were: 535.67 ms (39.32) for Memory-set Size 1; 558.34 ms (33.77) for Memory-set Size 2 and 570.79 ms (21.75) for Memory-set Size 4.

The increasing in the Memory-set Size was associated to a general and gradual increasing in the reaction time in all groups. In fact, one-way ANOVAs conducted to observe the effect of the Memory-set Size on each of the three groups considered showed a significant effect for monolinguals, $F(2, 22) = 32.69$, $p < .001$, $\eta^2 = .74$, bilinguals, $F(2, 22) = 34.66$, $p < .001$, $\eta^2 = .75$, and professional translators, $F(2, 22) = 12.11$, $p < .001$, $\eta^2 = .52$. Results for block 1 are reported in Figure 3.

■ *Figure 3.* **Memory-set Size effect on RTs in Block 1**

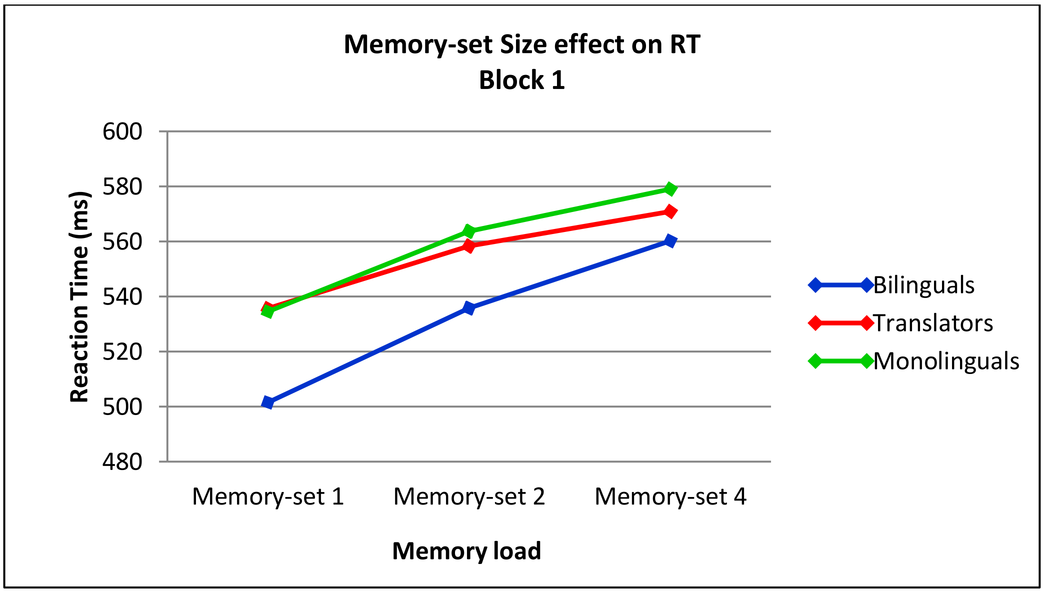

Figure 3. Effect of the Memory-set Size on the RTs of Monolinguals, Bilinguals and Translators in Block 1. The increasing in the Memory-set Size was associated to a general and gradual increasing of the reaction time in all groups.

Block 5 (300 last trials of the initial learning condition).

RT data for this block were analyzed through a 3 X 3 mixed analysis of variance (ANOVA). As in block 1, the Memory-set Size was introduced as within factor and the Group (monolinguals, bilinguals and translators) as between factor. There was a main effect for the Memory-set Size, $F(2, 66)$ =

41.75, $p < .001$, $\eta_p^2 = .55$. The differences between groups were significant, $F(2, 33) = 3.84$, $p = .03$, $\eta_p^2 = .18$. Planned comparisons revealed a different pattern compared to Block 1; in fact, significant differences between monolinguals and bilinguals, $F(1, 33) = 6.45$, $p = .01$, $\eta^2 = .16$, and between monolinguals and translators, $F(1, 33) = 4.98$, $p = .03$, $\eta^2 = .13$ were observed. Differences were not significant between translators and bilinguals, $F < 1$.

In Block 5 a significant Memory-set Size x Group interaction was observed, $F(4, 66) = 4.90$, $p = .001$, $\eta_p^2 = .22$. This last result suggests that the impact of the memory load effect on the three groups considered was different. Indeed, the one-way ANOVAs conducted to observe the effect of the Memory-set Size on each of the groups considered showed that the Memory-set Size affected significantly the reaction times of bilinguals, $F(2, 22) = 27.98$, $p < .001$, $\eta^2 = .71$, and professional translators, $F(2, 22) = 49.54$, $p < .001$, $\eta^2 = .81$. Nevertheless, the memory load did not affect the monolingual performance, $F(2, 22) = 1.04$, $p = .36$, $\eta^2 = .08$. In Block 5, Mean RTs (with standard deviations in parenthesis) for monolinguals were: 543.26 ms (41.53) for Memory-set Size 1; 551.94 ms (34.62) for Memory-set Size 2 and 552.66 ms (35.70) for memory-set Size 4. Mean RTs (with standard deviations in parenthesis) for bilinguals were: 486.90 ms (43.06) for Memory-set Size 1; 515.28 ms (48.80) for Memory-set Size 2 and 530.39 ms (37.36) for Memory-set Size 4. For translators, Mean RTs (with standard deviations in parenthesis) were: 495.02 ms (34.72) for Memory-set Size 1; 519.15 ms (38.85) for Memory-set Size 2 and 532.30 ms (32.12) for Memory-set Size 4. Results for block 5 are reported in Figure 4.

■ *Figure 4.* **Memory-set Size effect on RTs in Block 5**

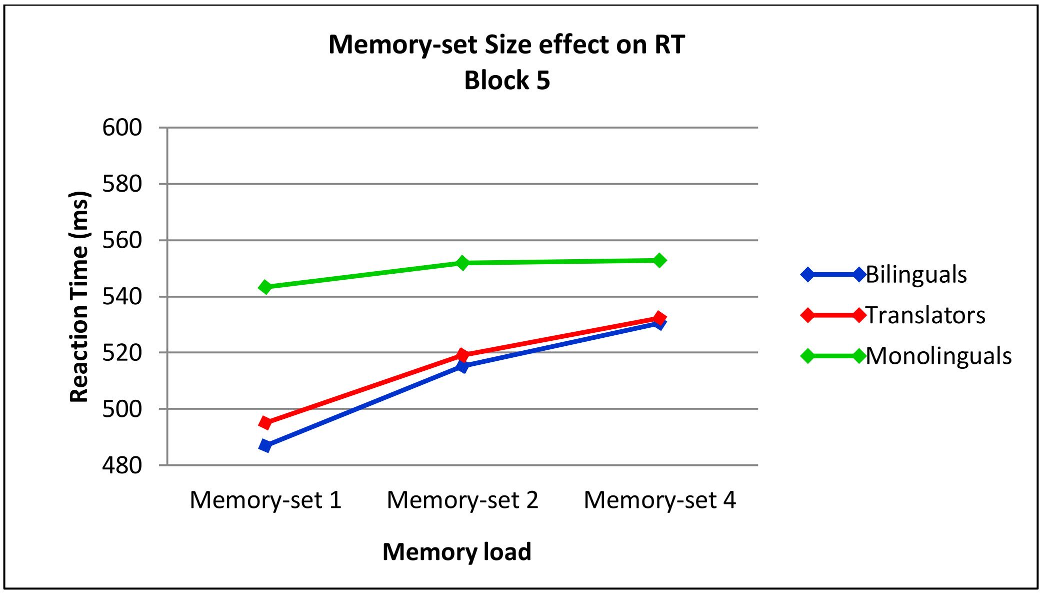

Figure 4. Effect of the Memory-set Size on the RTs of Monolinguals, Bilinguals and Translators in Block 5. The increasing in the Memory-set Size affected the performance of Bilinguals and Translators. The memory load did not affect the monolingual performance.

Coefficient of variation analysis in Blocks 1 vs. Block 5

CV was calculated for the three groups of participants in block 1 and 5, collapsing the Memory-set Size data within each block. For each participant, CV was calculated through the formula SD/RT. Figure 5 shows the changes in CV as a function of blocks and groups. A two-way ANOVA was performed introducing the Group (monolinguals vs. bilinguals vs. translators) and the Bock (1 vs. 5) as factors. The main effect of Group was not significant, $F < 1$. The main effect of Block was significant, $F(1, 33) = 9.32$, $p = .004$, $\eta^2 = .22$. The interaction Group x Block did not reach significance, $F(1, 33) = 1.11$, $p = .33$, $\eta^2 = .06$. However, statistical analysis was performed to compare CV from block 1 and 5 in each of the groups considered. Thus, a repeated measure ANOVA was carried out within each group, being the CV block the factor introduced in the analysis. Analysis revealed a significant main effect in the monolingual group $F(1, 11) = 8.84$, $p = .01$, $\eta^2 = .44$. No significant main effect was observed neither in bilinguals, $F < 1$, nor in translators, $F(1, 11) = 2.19$, $p = .16$, $\eta^2 = .16$. In other words, the CV dropped out significantly through practice only in the monolingual group (mean CV in block 1= .157; mean CV in block 5= .138) while the reduction of the variance in bilinguals (mean CV in block 1 = .161; mean CV in block 5= .153) and translators (mean CV in block 1 = .151; mean CV in block 5= .144) did not reach significance. The results for the coefficient of variation in block 1 vs. block 5 are reported in Figure 5.

■ *Figure 5.* **Coefficient of variation as a function of groups and blocks**

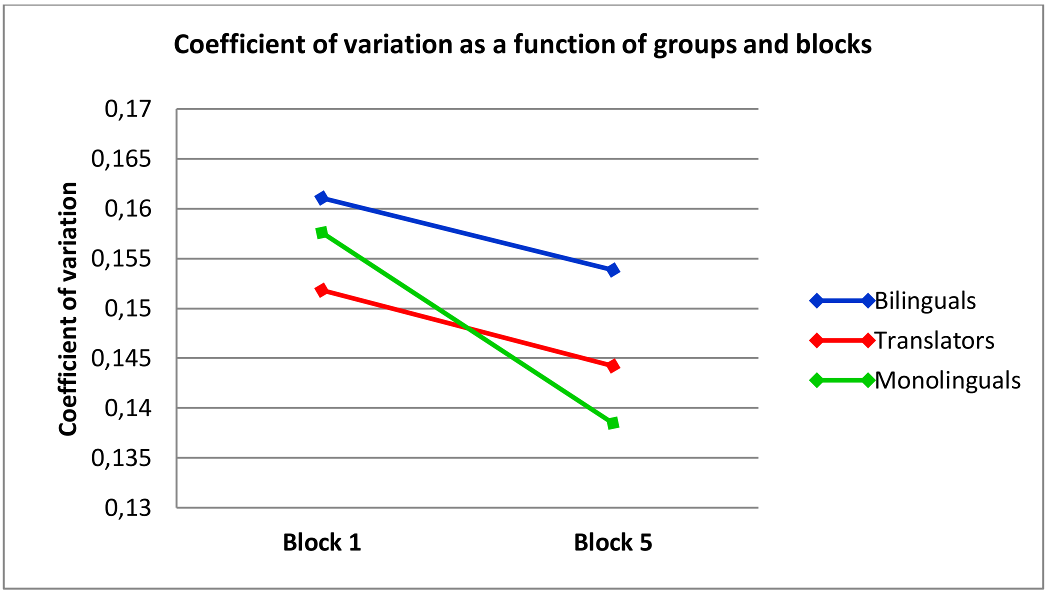

Figure 5. Change in the CV index as a function of blocks and groups The CV dropped out significantly through practice only in the monolingual group, indicating cognitive restructuring in automatization; however, the reduction of the variance in bilinguals and translators did not reach significance.

Block 6 (300 trials of reversed learning condition)

Block 6 is the block after the switch point. RT data were analyzed through ANOVA, as in previous blocks. The analysis yielded a main effect for Memory-set Size, $F(2, 66) = 29.89$, $p < .001$, $\eta_p^2 = .47$, indicating that overall an increase in the Memory- Set Size was associated to an increase in reaction times, and a significant main effect of Group $F(2, 33) = 11.58$, $p < .001$, $\eta_p^2 = .41$; Planned comparisons revealed significant differences between monolinguals and bilinguals, $F(1, 33) = 18.79$, $p < .001$, $\eta^2 = .36$, and between monolinguals and translators, $F(1, 33) = 15.81$, $p < .001$, $\eta^2 = .32$. Differences were not significant between translators and bilinguals, $F < 1$.

The interaction between the two factors did not reach significance, $F(4, 66) = 1.40$, $p = .24$, $\eta_p^2 = .07$. The one-way ANOVAs conducted to observe the memory load effect on the RT of the three groups suggest that the memory load did have an effect on the reaction times of all groups, being for monolinguals, $F(2, 22) = 8.83$, $p = .001$, $\eta^2 = .44$, bilinguals, $F(2, 22) = 15.69$, $p < .001$, $\eta^2 = .58$, and professional translators $F(2, 22) = 16.27$, $p < .001$, $\eta^2 = .59$. In Block 6, Mean RTs (with standard deviations in parenthesis) for monolinguals were: 582.59 ms (38.10) for Memory-set Size 1; 607.86 ms (67.54) for Memory-set Size 2 and 656.84 ms (81.13) for memory-set Size 4. Mean RTs (with standard deviations in parenthesis) for bilinguals were: 520.25 ms (31.02) for Memory-set Size 1; 550.31 ms (30.22) for Memory-set Size 2 and 563.55 ms (33.59) for Memory-set Size 4. For translators, Mean RTs (with standard deviations in parenthesis) were: 526.61 ms (34.02) for Memory-set Size 1; 551.41 ms (30.44) for Memory-set Size 2 and 573.75 ms (32.12) for Memory-set Size 4. Results for block 6 are reported in Figure 6.

■ ***Figure 6.* Memory-set Size effect on RTs in Block 6**

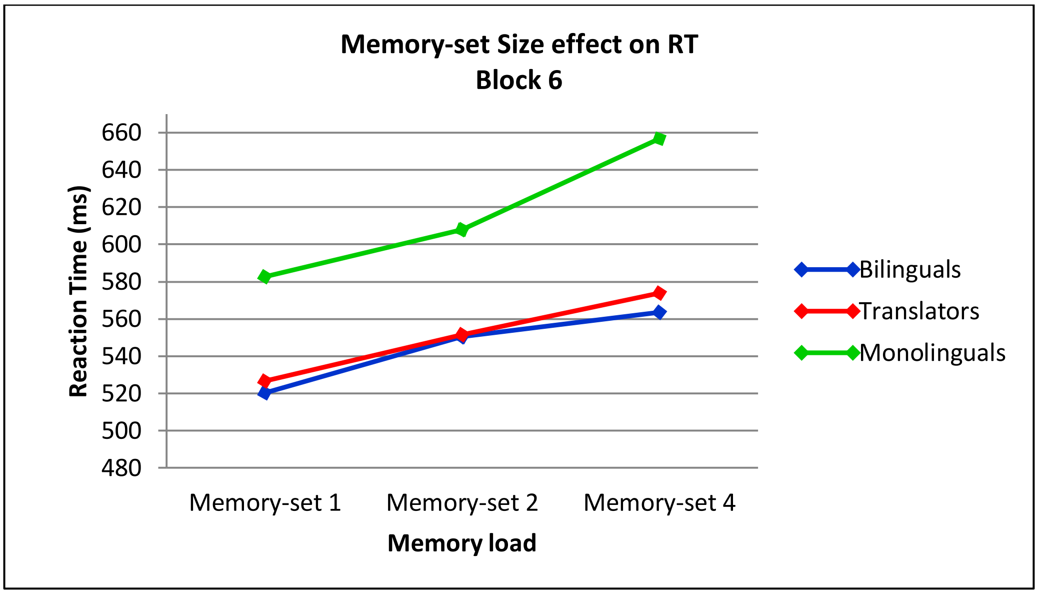

Figure 6. Effect of the Memory-set Size on the RTs of Monolinguals, Bilinguals and Translators in Block 6. The increasing in the Memory-set Size was associated to a general and gradual increasing of the reaction time in all groups.

Switch effect between initial and reversed learning

In order to test the effect that the switch point had on the performance of the three groups, data were analyzed through a 3 x 2 mixed ANOVA, being Group the between factor (monolinguals, bilinguals and professional translators) and Switch (participants' total mean reaction time in block 5 and 6) the within factor. The analysis yielded a significant main effect of Group, $F(2, 33) = 9.31$, $p < .001$, $\eta_p^2 = .36$, Switch, $F(1, 33) = 57.702$, $p < .001$, $\eta_p^2 = .63$, and the interaction between these two factors was also significant, $F(2, 33) = 3.22$, $p = .05$, $\eta_p^2 = .16$. One-way ANOVAs conducted in order to evaluate the switch effect in the three groups revealed that the switch produced a significant effect on the RTs of monolinguals, $F(1, 11) = 23.75$, $p < .001$, $\eta^2 = .68$, bilinguals, $F(1, 11) = 13.31$, $p = .003$, $\eta^2 = .54$, and professional translators, $F(1, 11) = 26.92$, $p < .001$, $\eta^2 = .70$. However, the Group x Switch interaction suggests that although the switch actually affected all the groups, it was higher in monolinguals than in bilinguals and professional translators. Mean RTs (with standard deviations in parenthesis) for Monolinguals before and after the switch were 549.29 ms (34.50) and 615.76 ms (53.92), respectively. For bilinguals they were: 510.86 ms (41.69) and 544.70 ms (27.39); and for translators, mean RTs before and after the switch were 515.49 ms (34.51) and 550.59 ms (34.29).

Results of the switch effect analysis are reported in Figure 7.

■ *Figure 7.* **Switch effect on RTs as a function of group**

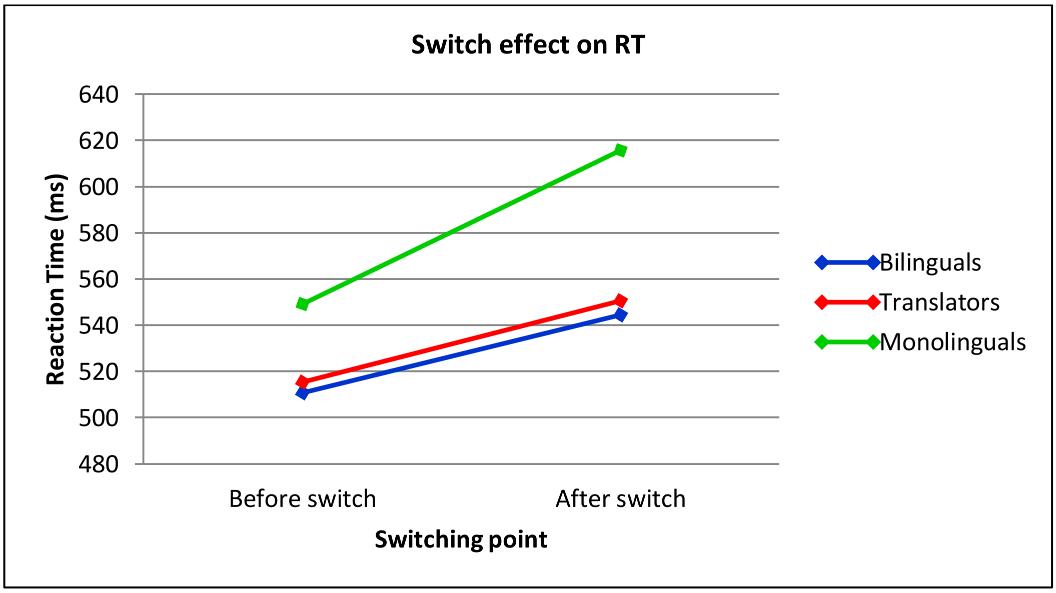

Figure 7. Switch effect between initial and reversed learning in the three groups considered (Monolinguals, Bilinguals and Translators). The switch affected all groups; however, it was higher in monolinguals compared to both bilinguals and professional translators.

DISCUSSION

The results obtained in the present study showed that at the beginning of the task, the memory search was carried out in a serial and controlled fashion for all groups, since the memory load affected all groups' RT in their memory search process, consistent with the findings by Shiffrin and Schneider (1977). Interestingly, in Block 1 we observed that overall RTs in response to the targets changed as a function of group. Translators and monolinguals did not differ in the initial part of the memory search task, and were slower compared to the bilinguals. After 1500 consistent practice trials, the Memory-set Size effect disappeared in the monolingual group, indicating that their memory search processes did automatize. Nevertheless, the Memory-set Size effect was still observed in bilinguals and translators. In other words, despite the consistent practice throughout the initial 1500 trials, their memory search was still highly dependent on the load, suggesting that bilinguals and professional translators along the trial kept performing their memory search processes in a controlled, resource consuming manner. Their pattern of performance differ from monolingual that showed a reduction in the memory search slope with practice suggesting that after practice, they performed search for the targets in a more automatic manner. Despite this pattern of results, it was interestingly observed that professional translators accelerated their -memory search processes, since in Block 5 they were as fast as bilinguals. On the other hand, monolinguals showed significantly slower RTs compared to the other two groups, which is quite surprising considering that automatization should also imply faster performance.

Coefficient of Variation analysis was performed to assess whether the changes in RT along the trials corresponded to a steady behaviour that usually underlies automatic processing and not to mere speed-up effects. It should be remembered that CV is expected to drop in case of automatization of performance, indicating that a qualitative change has been produced. The analysis confirmed that the CV dropped out significantly throughout the practice blocks in the monolingual group, while the reduction of variance in bilinguals and translators did not reach significance. Thus, the CV results are consistent with the analysis performed in the raw RTs by suggesting that cognitive restructuring was only present in monolinguals. In other words, the drop in CV across the trials for the monolingual participants indicated that their automatization process was not limited to the speed-up of performance; rather, it was based on a stable behavior to perform the task at hand. This claim is also supported by the pattern of results obtained in overall mean RT analysis (by collapsing the Memory-set Size): automaticity in task performance is a construct that is closer to the idea of cognitive restructuring rather than to mere speed-up of performance. In block 5, where consistent practice was carried out by all groups, monolinguals showed automatization (cognitive restructuring) despite being significantly slower compared to bilinguals and translators. On the other hand, trained and untrained bilinguals showed speed-up of performance despite maintaining sustained cognitive control over the task. In a sense, bilinguals and translators enhanced the cognitive control exerted over the task by speeding it up. This point is particularly important for the use of the construct of automaticity in language, since it confirms that speed-up and cognitive restructuring underlying automaticity are factors that are interconnected but function independently one from the other (for similar claims, see Segalowitz & Hulstijn, 2009).

The pattern of results obtained for translators was unexpected since we predicted that professional translators would show more automatic patterns than monolinguals and untrained bilinguals. This prediction was based on data that suggested that professional translation requires faster and more efficient processing during comprehension and retrieval processes (e.g., De Groot & Christoffels, 2006). The rationale behind our prediction was that practice in the efficient use of automatic processing during linguistic retrieval would transfer to non-verbal tasks recruiting similar mechanisms such as the one employed in the present study. However, contrary to our predictions, differences between bilinguals and translators were not detected in the search-in-memory task, and they both differed from the monolinguals in an unexpected manner.

On the other hand, we were interested in the switch effect manipulation: it was supposed to produce a cost in RTs, reflecting between-groups differences in the reestablishing of cognitive control when facing new tasks. Interestingly, monolingual participants showed larger switching cost (RT differences between trials before and after the switch) than bilinguals and translators. Similarly, memory search slope for the monolingual changed from being independent on load before the switch to be dependent on memory load with longer times for higher loads. This pattern suggests that the fact of automatizing performance during the learning phase had the side effect of increasing the switching cost when a new configuration of the task was introduced (after switching trials). Thus, although automatization was advantageous when considering learning consistent aspects of the skill (pre-switching trials), it has a cost when novelty is introduced. In contrast to monolinguals, both bilinguals and translators did not automatized their memory search during the training phase with the cost that along the trials search was dependent on the number of stimuli in the set. However, this apparently less efficient performance turned into an advantage when switching was introduced and the task required searches through previously distractor information.

The fact that bilinguals and translators showed the same pattern of performance suggests that the balance between automaticity and control is actually due to second language use rather than to domain specific translation practice. The lack of significant differences between bilinguals and translators implies that, at least in terms of balance between automaticity and attentional control in non-verbal tasks, the overall cognitive benefits derived from natural, untrained bilingualism are equivalent to those due to training in translation.

This fact, however, should not force towards the conclusion that any bilingual can translate professionally. As Bialystok & Depape (2009) suggest, an interesting feature of the cognitive advantage linked to bilingualism is that the same cognitive advantage is also found in other domains than bilingualism (e.g., musical expertise), emphasizing the role of domain- general mechanisms. Therefore, very different experiences can engage the same general cognitive mechanisms, although through requirements that are specific to those experiences (in our case, bilingualism vs. translation) (Bialystok & Depape, 2009). Probably, the regular use of two or more languages and the need to control and switch between them, force both bilinguals and translators to keep constant control over their languages and this constant control transfers to other non-verbal tasks. Previous research, however, suggests that bilinguals and translators differ in other cognitive control situations (Yudes et al., 2010; Morales et al., 2015).

To conclude, it is worth reminding that the identification of those skills with similar o dissimilar consequences on cognition is useful, since 1) it contributes to the understanding the functioning of domain- general mechanisms and 2) it might help to further isolate the mechanisms that are domain- specific, by which different experiences restructure cognitive functioning.

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CHAPTER IV [1]

COGNITIVE RESOURCES & TRANSLATION EXPERTISE: PROCESSING TWO LANGUAGES AT THE SAME TIME

This study evaluates the way in which interpreters activate the source language (SL) and the target language (TL) when they perform the interpreting task. We focused on syntactic ambiguities. In sentences like "Someone shot the servant of the actress who was on the balcony", two antecedents ("servant" and "actress") are potential correct agents of the clause (who was on the balcony). Previous studies showed that native English speakers interpret the second antecedent as the agent (actress); Spanish speakers prefer the first antecedent (servant), and Spanish/English bilinguals do not show any preference. In the present study we observed the interpreters' syntactic processing when they either read the ambiguous sentences in Spanish to repeat them in Spanish or read the sentences in Spanish to translate them into English. The way ambiguous sentences were processed depended on the task: professionals did not show a clear attachment preference when they read and repeated sentences while they used the strategy preferred in the TL when they performed the interpreting task. Interpreters managed TL syntactic properties in a flexible manner during the comprehension phase of the interpreting task.

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The rationale and part of the results of the experiment in this chapter was done in collaboration with Natalia Paredes and partially presented in her doctoral thesis. However, the introduction, part of the analyses and the discussion in this chapter are new and originally written for this thesis.

Interpreters and the Language Mode

Interpreters who have worked as professionals for years and become experts in their professional domain will surely report that they change the way they monitor the languages and how they handle the cognitive resources while performing the interpreting task (Grosjean 2001). When we think about interpreters as individual agents in broad social communicative contexts, it is easy to realize that they play at least three different roles in the environment they live in: firstly, interpreters are bilingual individuals in a monolingual language mode (Grosjean 1997), when they have to interact with monolingual individuals (see van Dijk & Kintsch 1983; Zwaan 1999; Harley 2001; for a complete overview of the cognitive sub-processes involved in monolingual language processing); secondly, they can switch to a bilingual language mode when they might want to interact with other L2 individuals or bilingual individuals (see also Kroll & de Groot 2005; Green & Abutalebi 2013; Kroll & Bialystok, 2013, for further information on bilingual language processing); Thirdly, professional interpreters need to function as experts every time they have to perform translation tasks: in this case, their languages are equally active but the processing mechanisms are not, since they have to input the source language (SL) and to output the target language only (TL) (Christoffels 2004; Gile 2008; Grosjean 2013), avoiding the cross-language mixing and borrowings typically observed in the bilingual language mode (Grosjean & Li, 2013).

An important question is whether the interpreters flexibly adapt the way in which the language is processed as a function of the linguistic task to perform. The aim of the present study is to provide evidence regarding this flexible use of language by the interpreters by focusing on syntactic processing during reading and translation. In the following sections, we first review the literature on the processes involved in interpreting, followed by a discussion of the relevant literature on language interactions at the lexical and syntactic levels with a special focus on bilingual processing of syntactic ambiguities as it applies to the present study.

The interpreting task from a cognitive perspective

From a cognitive viewpoint, interpreting is a challenging task, because of its multitask nature. The interpreter must be able to monitor two or more languages in the same communicative context and carry out many complex cognitive operations (input, processing and output) for each language in use. For the interpreter's performance to be smooth (accurate and acceptable in terms of perception-to-production lag), all the cognitive processes underlying the interpreting task have to be carried out rapidly and accurately. Most researches in this field tried to shed some light on how interpreters manage to control and monitor all the cognitive processes that allow them to maintain both languages active, just scaling the functioning of the input and output components required by the task (Grosjean & Li, 2013), maintaining a constant and reduced lag between the two operations (Oléron & Nanpon, 1964; Barik 1973; Christoffels, 2004). Cognitive constraints were widely recognized as one of the most critical limiting factors in the interpreting performance (Gile, 2008). As Gile suggests (2008), this idea can be found in several translation studies: Fukuii and Tasuke (1961), Oléron and Nanpon (1964), Kade and Cartellieri (1971), Kirchhoff (1976), in Moser's (1978) model of simultaneous interpreting, in Chernov's views on the simultaneous interpreting process (1994). Moreover, it was formalized as a central factor of interpreting difficulty in Gile's Effort Models (1995, 2008). Gile suggests the presence of three main cognitive constraints (efforts) while performing the interpreting activity. The first effort, called the Listening Effort, groups the cognitive operations "mobilized to allow comprehension of the source speech by the interpreter" (Gile, 2008); the second effort (production effort) refers to the processes underlying production in the L2, including self-monitoring and self-correction. Thirdly, the memory effort would allow the storage and retrieval in the very short term of the information that links the source and target speech (Gile, 2008). The Effort Model by Gile was subsequently used as an explanatory model, didactic tool, and also as a conceptual framework for empirical research in the field of translation. Gile (2008) suggests that studies by Chang and Shallert (2007), He (2007) and Seeber (2011) are a few examples of such work.

Researchers in cognitive psychology have also shown a strong interest in the interpreting activity as a complex skill (De Groot, 1997, 2000; Christoffels et al. 2006; Ruiz, Paredes, Macizo, & Bajo 2008). From a cognitive viewpoint, this interpreting activity involves, at least, three basic processes: (a) Source language (SL) comprehension (analysis of lexical units, syntactic processing and comprehension of the utterance meaning), (b) code switching or reformulation between the two languages involved in the task at hand, (c) linguistic production in the Target language (TL) (e.g., Gerver, 1976; Lambert, 1992; Padilla et al., 1995). An important concern of cognitive studies on interpreting has been to understand how the comprehension, processing and production mechanisms work together as an all-in-one process in interpreters, and how they interact on a temporal basis. We will focus on this issue in the next section.

Language interactions in interpreting tasks

Several studies in the cognitive field show that before interpreters complete the SL processing, they access the TL lexical/semantic level. In other words, they suggest that both languages are simultaneously activated and interact during comprehension for translation (Macizo, & Bajo 2006; Ruiz et al., 2008). For example, Macizo and Bajo (2006, Experiment 2) asked professional translators to perform interpreting of the utterances presented visually (they had to read sentences in Spanish and translate them into English). The cognate status of key words was manipulated; they selected Spanish/English cognates that shared both the meaning and the orthographic form (e.g., "piano"). The predictions were simple: if the participants had access to the TL lexical/semantic forms before they completed comprehension of the SL, reading would be facilitated for cognate words compared to control words. The results of this experiment confirmed the initial prediction. Reading times for cognate words in Spanish were faster than reading times for control words. Moreover, this cognate facilitation effect solely occurred when professionals read for translation; no effect was found when they were asked to perform the reading for repetition task suggesting that lexical processing is modified as a function of the task performed. Similarly, Ruiz et al. (2008, Experiment 1) provided further evidence for this finding using the same procedure as Macizo and Bajo (2006). In this case, the TL lexical frequency was manipulated for the critical words while controlling the frequency in the SL. Results showed that, during reading for translation, words with high frequency in the TL were processed faster than low frequency words, even if all the words had similar lexical frequency in the SL. Again, this effect was observed during reading for translation but not during reading for repetition. Therefore, as far as the lexical processing level is concerned, previous research confirms the finding that interpreters are able to keep both their languages simultaneously active when performing the task (they access the TL translation equivalents before they complete the SL perception process). Moreover, they must also be able to keep their two languages separated, since cross-language interference is considered as an index of low quality interpreting, and monitor the input and output mechanisms in a way that allows them to input the source language and to output the target language only (Grosjean, 1997). Nevertheless, the input component of both the source and target language is activated, since lexical and semantic TL features are retrieved during SL reading.

Although studies in the translation domain have evaluated the interpreting task at the syntactic level, which is, parsing, syntactic structures and syntactic complexity in the SL, etc. (e.g., Liu & Chiu 2011), research concerning the syntactic processes involved in interpreting from a cognitive view is scarce. One of the few studies focused on syntactic processing during interpreting was reported by Ruiz et al. (2008, Experiment 2). A group of translators read sentences either for repetition in Spanish or translation into

English. On this occasion, the authors manipulated the congruency in word order between the SL and the TL. In congruent sentences, the adjective was presented before the modified noun, and the subject always preceded the verb of the relative clause (e.g., *la bonita casa que yo alquilé este verano tenía un verde jardín*). This Spanish structure is congruent with the syntactic form used in English (note that, in English, adjectives always appear before the noun and the subject tends to accompany the verb, e.g., *The nice house that I rent this summer had a green garden*). In contrast, in incongruent sentences, the necessary TL relation between the adjective-noun and the subject-verb forms was not presented; e.g., *la casa bonita que alquilé este verano tenía un jardín verde*). Although prenominal adjectives acquire pragmatic implication in Romance languages, in the study by Ruiz et al. (2008) this pragmatic effect was reduced using a word-by-word presentation paradigm. The results of the study showed that while performing the interpreting task, participants did actually read faster the congruent sentences than the incongruent ones, that is, they comprehended faster the input information when there was a match between the syntactic structures of the two languages involved in the interpreting process; however, no differences were observed when reading for repetition. The same pattern of results was observed when the interpreters read sentences in their second language (L2, English) for later translation to L1 (Spanish). Congruent syntactic sentences were read faster than incongruent sentences suggesting that participants activated syntactic knowledge of the target language during the reading of sentences that had to be translated afterwards (Paredes, 2011).

Therefore, it seems that the pattern observed in lexical access which is, the facilitation effect observed for cognate words (congruent condition) (Macizo & Bajo, 2006), also holds for syntactic processing, since congruent sentences triggered faster reaction times than incongruent sentences.

Moreover, the facilitation effect found between languages in syntactic processing confirms that both languages are simultaneously active during the task (Hartsuiker et al., 2004) even if interpreters can maintain them independent (they do avoid interference). The facilitation effect also shows that they retrieve the syntactic structure of the TL for production before they complete the comprehension process in the SL, so that they succeed in employing the input and output mechanisms simultaneously but independently one from the other, scaling their level of activation also at the syntactic level.

In the present study, we aimed to further assess the functioning of the SL input and TL output mechanisms which underlie syntactic processing during interpreting by observing processing differences in the resolution of syntactic ambiguities by the interpreters when the task changes from a monolingual to a bilingual mode.

Processing of ambiguous sentences in monolinguals and bilinguals

In the present study, we focused on how professionals solve syntactic ambiguity when performing the interpreting task. It has been shown that cross-linguistic differences exist when comprehending ambiguous relative sentences (Carreiras 1992; Carreiras & Clifton 1999; Gilboy, Sopena, Clifton, & Fraizer 1995). In sentences like *Someone shot the servant of the actress who was on the balcony* there are two antecedents, "servant" and "actress", and both are potential correct agents of the clause "was on the balcony". Native English speakers solve the ambiguity adopting a low attachment strategy, in line with the late closure principle proposed by the *Garden path theory* by Frazier (Frazier 1978; Frazier & Rayner 1982). According to this strategy, new elements (the relative clause) are attached to the noun phrase currently being processed, the most recent one (*the actress*). However, previous research has consistently shown the existence of cross-linguistic differences in relative clause attachment (Gilboy et al., 1995; Carreiras & Clifton 1999), through the use of different experimental procedures, such as post-process evaluation (asking questions on the agent e.g., *Who was on the balcony?*) or on-line comprehension measures (reading times, Cuetos & Mitchell 1988). Many researchers report that native speakers of Spanish prefer to identify as agent of the relative clause (*was on the* *balcony*) the first antecedent of the sentence (*servant*), employing a high attachment strategy (Carreiras & Clifton 1999). Interestingly, unlike monolinguals, bilinguals do not show any attachment preference when processing ambiguous clauses. Fernández (2003) evaluated the attachment preference in English monolinguals and Spanish-English bilinguals. All participants were first asked to read complex predicative sentences which included relative clauses similar to those mentioned (*Someone shot the servant of the actress who was on the balcony*) and, secondly, to answer some questions (e.g., Who was on the balcony?). The aim of this task was to assess whether participants used a high attachment strategy, as Spanish monolinguals did (the servant was on the balcony) or, instead, they used a low attachment strategy, which is common in English monolinguals (the actress was on the balcony). As expected, native English monolinguals preferred a low attachment strategy (73%). By contrast, English-Spanish bilinguals did not show a clear preference towards either high or low attachment. These participants opted for low attachment in 49% and high attachment in 51% of the clauses presented. Similarly, Dussias (2001) evaluated a group of English monolinguals and English-Spanish bilinguals. All participants were instructed to first read predicative sentences in English and, secondly, to answer an agent attachment questionnaire. Data showed that English native speakers preferred low attachment in 86% of cases. However, the selection of the preferred attachment in English (low) was reduced to 56% in the case of English-Spanish bilinguals. The fact that bilinguals do not show any clear attachment preference seems to suggest that their two languages are simultaneously activated and influence each other so that syntactic processing preferences in one language change under influence from the other language.

The present study

As already said, the goal of the current study was to evaluate the processing of syntactic ambiguities in order to determine the functioning of the activation of the SL input and TL output mechanisms in interpreters at the syntactic processing level while reading for repetition and reading for translation.

The two psycholinguistic theoretical models that frame our research and can be integrated to explain the way interpreters carry out the syntactic analyses depending on the task they are performing are the Grosjean's Language Mode Theory (1997, 2001, 2013) and MacWhinney's Competition Model (1992). According to Grosjean, the relative activation of the two languages would depend on the linguistic context. Thus, even a bilingual may adopt a monolingual mode when the context requires the use of only one language. In contrast, when interpreters perform their task both the SL (the one heard) and the TL (the one spoken) are active because both are needed, for comprehension and production respectively (Grosjean, 2013). Thus, the model would predict that the resolution of syntactic ambiguities in our experiment might differ depending on whether the task to be performed involves one (reading for repetition) or two languages (reading for translation). On the other hand, according to MacWhinney's competition model, proficiency in L2 leads to the development of new strategies that can be flexibly used to reduce interference from the L1. When the language user moves towards the mastering of the L2, he/she attempts to restructure the L2 in such a way as to avoid reliance and transfer from L1. As the beginner learners become experts, they develop a series of strategies that will allow the use of direct L2 strategies instead of transferred L1 to L2 strategies, since "if the target forms are passed through an L1 filter, the learner will never be able to detect a mismatch between one's own forms and the correct target forms" (MacWhinney, 1992: 6). Both models stress the idea that expert users of language are able to detect the mismatch between their L1 and L2 (MacWhinney, 1992) and remap their L2 linguistic approach avoiding interference. In order to do this, users modulate their cognitive behaviour (input and output mechanisms) according to the requirements of the task they may want to perform (Grosjean, 2013), adopting the TL preferred strategies (MacWhinney, 1992).

To test these ideas, we adapted the procedure previously employed by Macizo and Bajo (2006) to the analysis of ambiguous clauses. English-Spanish interpreters were asked to read ambiguous relative clauses for repetition in Spanish or for interpreting into English. After performing the task, interpreters were instructed to answer to the verification questions about the possible agent of the sentences; this revealed the attachment strategy they employed while performing the task. Our interest was to observe the interpreters' processing when they either read the sentences in Spanish and repeated them in Spanish or read the sentences in Spanish and translated them into English. According to the Language Mode Theory (Grosjean, 1997; 2013), the relative activation of the two languages of the bilingual or interpreter would depend on the linguistic context. Thus, the model would predict that the resolution of syntactic ambiguities in our experiment might differ depending on whether the task involved one language (reading for repetition) or two languages (reading for translation). Thus, our expectations were that when participants were reading for repetition they would either behave as monolinguals and show the attachment preferences related to their L1 (monolingual mode) or similar to the bilinguals in previous studies (Fernández 1995) would not show any clear attachment preferences The latter result would follow predictions of MacWhinney’s competition theory (2005), since for bilinguals and interpreters (who are familiar with the syntactic cues used in their two languages), the weight associated to L1 and L2 attachment preferences would be similar. Thus, both strategies would be active and available as possible ways to understand ambiguous sentences, resulting in the lack of any clear attachment preferences.

Importantly, clear predictions can be made about ambiguity resolution when interpreters read the SL for later interpretation. In this case, participants would activate the TL at the syntactic level while reading in the SL and thus, they would use the syntactic preferences of the TL (low attachment strategy) during the comprehension of syntactic ambiguities in the SL while reading for interpreting afterwards.

METHOD

Participants

A group of 27 professional interpreters who had more than two years' experience as in-house interpreters was tested (Mean experience in years: 4.85). Their mean age was 31.33. They all were graduated in Translation and Interpreting Studies. The group included 14 men and 13 women. Their mean age of L2 acquisition was 5.63 years (they all started to learn L2 at school). Participants received payment for their participation.

Participants' first language was Spanish (L1) and English was their second language (L2).

The interpreters were asked to fill out a language history questionnaire to assess their fluency in L2 (adapted from Li, Sepanski & Zhao, 2006; see Chapter VIII, Appendix A). In this questionnaire, participants scored on a ten-point scale (where 1 is not proficient and 10 is very proficient) their skills in reading, oral comprehension, writing, and speaking in their two languages. All participants demonstrated to be fluent speakers of both languages, reaching an average score of 9.36 (SD = 0.76) in L1 and 7.49 (SD = 1.24) in L2. T-test revealed significant differences in proficiency between their two languages, $t(26) = 8.34$, $p < .001$; these data show that even if interpreters were proficient in both English and Spanish, their dominant language was Spanish (L1). Previous studies have observed that professional interpreters have high working memory (WM) as measured with the reading span test (Macizo 2003; Macizo & Bajo 2006; Padilla, Macizo, & Bajo 2008). In order to corroborate that interpreters in this study also had high reading span, they completed a Spanish version of the reading span task (Daneman & Carpenter 1980). In this test, participants are instructed to read sets of sentences presented one-by-one and to recall the sentence-final word after reading each set. The sets range from 2 to 6 sentences. The maximum number of final words correctly recalled represents the participant's reading span. The average reading span score was 3.94 (*SD* = 0.91). Considering Miyake, Just and Carpenter's (1994) criterion, we may confirm that participants showed a high working memory capacity. Table 1 shows participants' demographic characteristics and their linguistic competence report.

■ **Table 1**

Participants' demographic characteristics

Demographic characteristics	
Age (years)	31.33 (5.57)
Years of professional practice	4.85 (3.07)
Reading span capacity	3.94 (0.91)
Linguistic competence report	
Speaker's fluency in L1	9.03 (1.01)
Oral comprehension in L1	9.62 (0.71)
Writing competence in L1	9.22 (1.05)
Reading competence in L1	9.55 (0.69)
Speaker's fluency in L2	6.77 (2.13)
Oral comprehension in L2	7.74 (1.37)
Writing competence in L2	7.48 (1.45)
Reading competence in L2	7.96 (1.22)
Translation expertise	8.11 (0.57)

Note: self-reported measures in L1 (Spanish) and L2 (English) ranged from 1 to 10, being 1 non-fluent and 10 very fluent. Self-reported measures in translation expertise ranged from 1 to 10, being 1 low experience and 10 high experience. Standard deviations are presented in brackets.

Materials and design

The type of task that the participants performed (reading for repetition vs. reading for translation) was manipulated within-subjects (see Chapter VIII, Appendix B for complete stimulus material). Thirty-six sentences in Spanish were created; these were characterized by ambiguous syntactic structures and comprised relative clauses formed by a double antecedent (see Table 2). In all sentences, ambiguity arose in relative clauses. The last part of the sentence had to be attached to one of the two antecedents without relying on any syntactic or semantic indicator that might direct towards one of the two attachment preferences. In order to reduce the potential influence of the adjective-noun order, the two antecedents that might be the agents of the relative clause were not accompanied by adjectives, so as to avoid any possible congruent/incongruent condition based on the adjective- noun word order in Spanish.

■ **Table 2**

Example material used in the experiment

Ambiguous sentence

El dentista atendió a la secretaria de la directora que se divorció de su marido
(*The dentist attended to the secretary of the director who divorced her husband*)

Verification

¿Quién se divorció? (*Who got divorced?*)
a) La secretaria (*The secretary*) b) La directora (*The director*)

Filler sentence

El café estaba más amargo que el té que tomamos para merendar
(*The coffee was more bitter than the tea we had for snack*)

Verification

¿Qué estaba más amargo? (*What was more bitter?*)
a) Café (*The coffee*) b) Té (*The tea*)

Note: Example material (ambiguous sentence and filler sentence together with their respective verification questions) used in the experiment. English translations are given in brackets.

In order to ensure both the similarity between the two antecedents of each experimental sentence and avoid biasing the participants' preferences, lexical frequency was controlled (Alameda & Cuetos, 1995), as well as word-length (number of letters in each word). Statistical analysis did not show any significant frequency differences between the two antecedents in the sentences, $t(35) = 1.15$, $p > .05$. The mean frequency for the first antecedent was 185 times per 2 million words ($SD = 347.5$) and the mean frequency for the second antecedent was 101 times per 2 million words ($SD = 228.6$). Similarly, the mean word-length was equivalent for the two antecedents, $t(35) = -1.84$, $p > .05$. The mean word-length for the first antecedent was 6.4 ($SD = 2.1$) and for the second, it was 7.2 ($SD = 1.7$). In addition, we controlled for gender in the two antecedents. The percentages of feminine (33%) and masculine gender (67%) of the first antecedent were equated to the percentages of feminine (27%) and masculine gender (73%) of the second antecedent, $\chi^2 = 0.86$, $p > .05$.

In addition to the 36 syntactically ambiguous experimental sentences, we constructed 26 filler sentences (non-ambiguous sentences) whose structural complexity was equal to the experimental sentences. We introduced fillers for two reasons: first, we wanted to avoid possible bias due to the fact that participants were repeatedly reading ambiguous sentences; second, we wanted to make sure that participants read the sentences so as to comprehend them, thus, filler sentences were followed by a verification question whose correct answer matched with one of the alternatives presented (see Table 2). Before carrying out the present experiment, we decided to replicate the high attachment preference typically observed in Spanish native participants (Cuetos & Mitchell, 1988). Thus, we designed a pilot study in which the 36 ambiguous sentences were presented randomly together with the 26 filler sentences to 104 monolingual Spanish students from the University of Granada. Participants were instructed to read the sentences and to answer to a verification question after reading each sentence, underlining their preference (in ambiguous sentences) or the correct answer (in filler sentences). Participants showed a high attachment preference, $F(1,103) = 29.75$, $MSE = 405$, $p < .001$). The mean percentage of relative clause attachment to the first antecedent was 57.62% (*SD* = 14), while it was 42.38% (*SD* = 14) to the second antecedent. As a consequence, the pilot study allowed us to validate our experimental sentences and observe that Spanish native speakers prefer to attach the relative clause to the first antecedent.

Procedure

The experiment was programmed using E-prime (Version 1.1, Schneider, Eschman, & Zuccolotto 2002). Two experimental blocks were created, each comprising 31 sentences: 18 experimental sentences and 13 filler sentences, presented randomly. Before each block, participants were instructed to read and repeat the sentences in Spanish or to read and translate them into English. The order of the blocks (reading for repetition and reading for translation) was counterbalanced across participants. Across participants, all sentences appeared evenly in the reading for repetition and the reading for translation conditions.

Trials began with a fixation point followed by a sentence. Each sentence appeared in its entirety across one line on the computer screen. Participants were instructed to read each sentence at their own pace; after reading the sentence, participants pressed the space bar and the message "task" appeared on the screen, in order to repeat or translate the sentence, depending on the block presented. After performing the task, the message "verification" appeared on the screen, followed by a question about the sentence. To answer the verification question, two alternatives were provided and participants had to choose what they thought the correct one was by pressing one of two buttons. In the experimental sentences, the verification question was used to evaluate the preferred interpreters' attachment strategy, given that the question focused on the agent of the ambiguous relative clause and that the alternatives of the answer contained the two potential antecedents. In the filler sentences, the verification question was employed so as to corroborate that participants were reading to comprehend, given that questions focused on something inherent to the sentence and just one of the two alternative answers was correct (see Table 2 for an example). The two alternative answers appeared at the centre of the screen, on the left and right side, respectively. Participants had to press the z/m button, depending on their choice (left or right alternative, respectively). The position of the alternative answers (left/ right) was counterbalanced across participants. After responding to the verification question, participants pressed the space bar in order to follow with the next sentence. The whole experiment lasted 45 minutes per person.

RESULTS

The analysis of the answers to the verification questions used for non-ambiguous (filler) sentences showed a low percentage of comprehension errors for both reading (14.24%, SD = 29.54) and translation (13.96%, SD = 28.86); no significant differences were found between the two tasks, $F1$ and $F2 < 1$. This result suggests, firstly, that interpreters read the sentences in order to comprehend their meaning and, secondly, that comprehension accuracy does not depend on the task they had to perform. In order to evaluate the strategies adopted to solve syntactic ambiguity, the interpreters' attachment preferences for the ambiguous sentences were recorded. The amount of relative clause attachment preferences for the first and second antecedent was computed, that is, high and low attachment, respectively.

Analyses of Variance (ANOVAs) for repeated measures were performed with the type of task (reading for repetition vs. reading for translation) and the attachment preferences (high attachment vs. low attachment) as within-participants factors. Two ANOVAs were reported, one with participants as the random factor ($F1$) and other with items (sentences) as the random factor ($F2$). The main effect of type of task (reading for repetition vs. reading for translation) did not reach significance, $F1$ and $F2 < 1$. No significant main effect was found for the attachment strategy type, $F1(1, 26) = 1.16$, $MS = 1071$, $p > .05$, $\eta^2 = .04$, $F2 < 1$. Nevertheless, the Type of task x Attachment preferences interaction was significant by subjects, $F1(1, 26) = 3.93$, $MS = 464$, $p < .05$, $\eta^2 = .13$, and marginally by items, $F2(1, 24) = 3.62$, $MS = 394$, $p < .06$, $\eta^2 = .13$. Planned comparisons were performed to analyse further the interaction. When participants were instructed to read and repeat in Spanish, no effect of the attachment preference was observed. Hence, the difference between the high attachment preference and the low attachment preference was: $t(26) = 0.19$, $p > .05$, $d = .07$. Consistent with this data, the mean percentage of preference for the first antecedent was 50.72% ($SD = 19$), while the mean percentage of preference for the second antecedent was 49.28% ($SD = 19$). By contrast, when participants had to read for translation, the effect of the attachment preference was significant, so there were differences between the high attachment preference and the low attachment preference, $t(26) = 1.97$, $p < .05$, $d = .76$. The interpreted preferred the low attachment reference so the mean percentage of relative clause attachment to the first antecedent was 42.50% ($SD = 42$); and to the second antecedent was 57.50% ($SD = 20$) (see Figure 1).

■ *Figure 1.* **Attachment strategies as a function of task.**

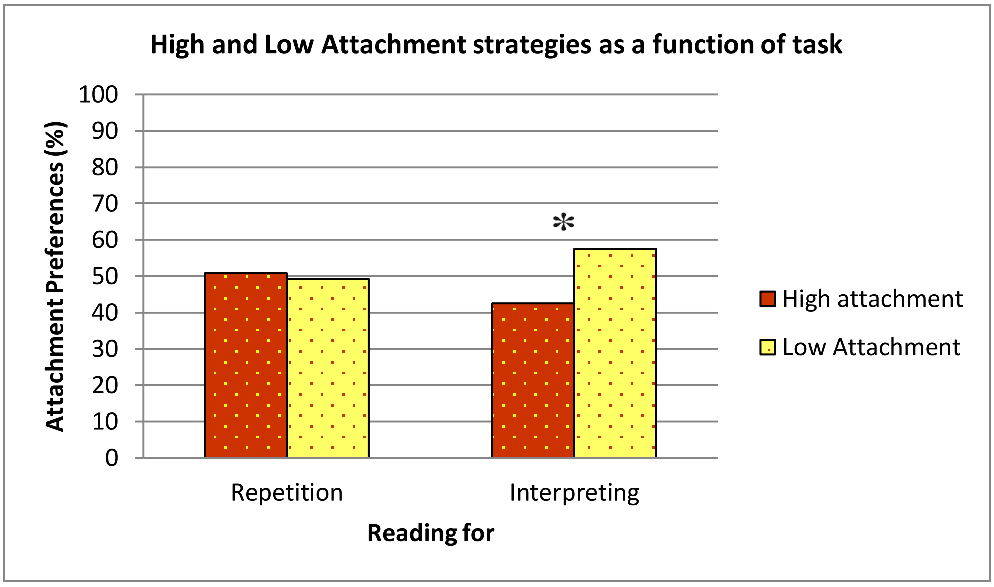

Figure 1. Results: attachment strategies. On the horizontal axis, Reading type (reading for repetition vs. Reading for translation) is reported. On the vertical axis, Choice percentages are presented.

Consequently, the attachment strategies used by professional interpreters to solve syntactic ambiguity in relative clauses depended on the task type they perform. When participants read and repeated in Spanish, no preference towards one of the antecedents was observed. When participants read in Spanish and translated into English, they preferred low attachment.

DISCUSSION

The aim of the present study was to further explore the the interplay between the cognitive operations used to interpret speech across languages to try to understand how the SL and TL processes underlying interpreting are triggered in the interpreter's mind when needed for the task. More precisely, we focused on the syntactic level of processing by examining cross-linguistic differences during the analysis of ambiguous relative clauses. Previous research has shown that the way ambiguous relative clauses like "*Someone shot the servant of the actress who was on the balcony*" are comprehended depends on the language of use (see Cuetos & Mitchell, 1988, for data on Spanish native speakers; see Rayner, Carlson, & Frazier, 1983, for data on English natives). On the other hand, bilinguals do not show any preferences in syntactic attachment strategies (Fernández, 1999).

Interestingly, results of the present study showed that the way ambiguous sentences were processed by interpreters depended on the task they were performing. If we focus on the results obtained in the reading for repetition task, we observed that professional interpreters, despite being Spanish native speakers, did not show any preferred attachment strategy, which means that they might use both the high attachment strategy observed in Spanish monolinguals and the low attachment strategy observed in the English monolingual group. What is the cognitive mechanism underlying this behaviour? Before evaluating what happens in the interpreter's mind, we should first understand what happens in a monolingual individual. According to the Competition model by MacWhinney (2005) readers use syntactic cues to parse sentences during the comprehension process. Most of the cues, such as word order (i.e., subject-verb) and animacy (i.e., an animate noun is usually the subject of the sentence) are shared across the languages of a bilingual individual. However, the relative weight of these cues when the reader parses a sentence is language specific; actually, word order is more important in English than in Spanish. Accordingly, we should assume that the weight of the attachment preference is language specific; by consequence, although high and low attachments are possible and lead to a correct understanding, the weight of high attachment in Spanish would be higher compared to English, while low attachment would have more weight in English than in Spanish. This explanation would account for the way monolingual speakers understand ambiguous sentences. This interesting phenomenon can also be explained through the language mode theory proposed by Grosjean (1997, 2001, 2013).

"The language mode is the state of activation of the individual's languages and language processing mechanisms at a given point in time" (Grosjean, 2008: 38). According to this view, "the monolingual language mode will arise when the interlocutor or the situation is monolingual and/or other factors require only one language to be spoken to the exclusion of the other" (Grosjean, 2008: 42). Hence, in a context in which only one language is needed, the interlocutor and even the bilingual speaker would in all probability enter a monolingual mode. By consequence, the preference towards a well-established attachment strategy is justified by the monolingual language mode that the monolingual speakers are when performing a linguistic task.

According to MacWhinney (2005), in the case of bilinguals, who are familiar with the syntactic cues in their two languages, the weight associated to attachment preferences would be similar, so both strategies would be active and used as possible ways to understand ambiguous sentences, resulting in the lack of any clear attachment preferences. Accordingly, bilinguals show less preference for high attachment than Spanish native speakers. The investigation carried out by Dussias (2001) favours this interpretation. While English native speakers select the preferred low attachment strategy in L1 (86% of cases), English-Spanish bilinguals reduce this preference to 56%. Grosjean's interpretation of this phenomenon is that bilinguals continuously have to decide, usually quite unconsciously, which language to use and how much of the other language they will need: "if the other language is not needed, then it will not be called upon/ activated. If, on the other hand, the L2 is needed, then it will be activated (bilingual mode). A bilingual mode will also arise when the task at hand requires processing in the two languages" (Grosjean, 1999: 2). Thus, in Grosjean's terms, bilinguals do not show any clear preference in attachment strategy because their L1 and L2 are both active.

In the group of interpreters, the differences in reading for repetition and reading for interpreting suggest that the value of the syntactic cues reported by MacWhinney (2005) is not fixed in professional interpreting practice: it varies depending on the task. Accordingly, interpreters selected the TL preferred strategy during the interpreting process, which suggests that the weight of low attachment was larger relative to high attachment in this task.

The pattern of results obtained can be easily accommodated within the Language Mode Hypothesis (Grosjean, 2013). When interpreters did not perform the interpreting task (reading for repetition), they behaved like untrained bilinguals. As previously mentioned, bilinguals do not show a clear attachment strategy probably due to a balance between the activation of both the strategies preferred in their first language (high attachment in Spanish) and in their second language (low attachment in English). However, they changed their language mode when they were asked to perform the reading for translation task. Since the receiver of the translated sentence (an English reader) would prefer low attachment, the interpreters adjusted their understanding of the sentence to the syntactic strategy preferred by the receiver of the translated message. Grosjean's suggestion is that the input and output processing mechanisms of each language are indeed separated in such cases. The author puts forward the view that "first, the interpreter is in a bilingual mode and both languages are active; however, one language is not more active than the other as it is normally the case in the bilingual mode. Both the source and the target language are simultaneously active, to the same extent, as both are needed, for perception and production respectively" (Grosjean, 2008: 62). The results of this experiment confirm this view and, moreover, suggest that the parallel processing of the SL and TL during interpreting is not restricted to the lexical/semantic analysis (Macizo & Bajo 2006; Ruiz et al., 2008), but it can also be applied to the syntactic features of the languages involved.

According to Grosjean, during the interpreting task, input and output components have been added to each language and it is their levels of activation that varies. Although the two languages are equally active, the processing mechanisms are not. In this way, the interpreter will be able to input the SL and to output the target language only. The target language output mechanism is active whereas the source language output mechanism is not (it may be totally deactivated or, quite exceptionally, inhibited). In sum, the two languages are in a bilingual mode (both are active), the output mechanisms are in a monolingual mode (only one language is normally output) whereas the input mechanisms are in a bilingual mode (Grosjean, 2001: 20). This would explain why interpreters are able to ignore the attachment strategy which is not adequate in the output TL.

The idea of language mode is closely related to the executive processes that the interpreters have to manage when they perform the interpreting tasks. These individuals must monitor the interactional context, maintain their goal (the efficient mapping of SL stimulus onto adequate TL responses), resist and avoid interference from both the more dominant language and other TL competing responses that may be triggered by the situation. The results of our study suggest that the training the interpreters had undergone flexibly changed the way they performed the syntactic analysis depending on the task, allowing them to adjust their linguistic behavior according to the need imposed by the task. Hence, these professionals seem to activate and manage cognitive sets efficiently due to their specific expertise in translation and interpreting.

In the study, we focused on the interpreting task by evaluating whether syntactic analysis was modulated by between-language interactions underlying the interpreting process. However, the results found in the experiment remain silent on whether differences between the parsing of sentences to be repeated and to be translated were related to specific training of interpreters in linguistic tasks or due to the fact they were bilinguals. Future research will shed light on possible differences due to expertise in translation. Nevertheless, the main point to highlight from the current study is that the interpreting task is characterized by between-language interactions which change the parsing of the SL to accommodate the understanding of sentences to the way the message needs to be produced in the TL.

CONCLUSIONS

The present study confirms in the syntactic domain that professional interpreters, when required, manage TL properties in a flexible manner during the comprehension phase of the interpreting task. Simultaneous activation of the SL and TL mechanisms is taking place not just during lexical and semantic processing (Macizo & Bajo 2006; Ruiz et al., 2008) but also during the processing of syntactic ambiguities. This finding has important practical implications for the training of interpreters. A trend in training programs for professional interpreters is the "process-oriented approach" (Gile 1994): it postulates that interpreting students have to practice the operations they will need in the future in order to perform reformulation tasks. Given our results, this training should include practice both in the awareness of cross-linguistic differences in the syntactic processing of information and in the control of the influence that the more dominant language might exert over the processing of the less dominant language. The evidence suggested that experts solve the translation of cross-linguistically different syntactic forms by adopting the preferred TL strategy; this point leads us to think that translation and interpreting students should be trained in both L1 and L2 preferred linguistic strategies; in fact, our data appear to suggest that these syntactic strategies are language specific and require expert control over their use according to the language of production, since this is what the experts do in their profession. Future research should try to understand if the phenomena observed in the lexical, semantic and syntactic domains generalize to higher discourse levels (discourse parsing, pragmatic communicative intentions, formulaic language, metaphors, etc.) so as to train future interpreters in factors that may be important for simultaneous perception and production of SL and TL components.

Finally, it is important to mention that in our first step towards the understanding of this research topic, we were though interested in the observation of the cognitive mechanisms underlying the interpreting activity as a whole, focusing on the high-level mechanism of SL and TL interplay of syntactic activation in comprehension and production, an aspect that can be observed even if the experimental procedure adopted in the present study did not involve spoken speech but written text. Nevertheless, a very relevant point that deserves to be studied in future is the observation of the interpreting activity as it occurs in real communication, which is, employing speech rather than text inputs. Future studies should try to test the results from the current study using an experimental procedure based on oral rather than visual presentation of materials.

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CHAPTER VI[1]

IDIOMATIC PROCESSING IN BILINGUAL AND TRANSLATION EXPERTISE

In this chapter, we wanted to explore the predictions made by hybrid models on bilingual idiomatic processing regarding a possible differential access to the idioms as a whole depending on whether the bilinguals' experience fosters stronger associative links among the idiom' s constituent lemmas. Since we wanted to explore both the L1 idiom comprehension phase and the L1 to L2 mapping between the figurative meanings, we employed a translation task where we manipulated the cross-language congruency between idiomatic expressions, and compared their comprehension relative to matched non-idiomatic, control expressions. Our hypothesis was that professional translators would be able to map L1 and L2 idiomatic expressions (at the superlemma level) in a relatively more automatic and efficient way than untrained bilinguals, due to their extensive practice in acquiring the specific sub-skills involved in the translation process.

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Models of idiomatic processing in monolinguals

Idiomatic expressions (e.g., *hit the road*) are multiword conventional expressions whose semantic meaning cannot be derived from the comprehension of the individual words comprised in the sentence (Cacciari & Tabossi, 1988). These expressions are very common in natural language: one-third to one-half of language is based on idiomatic expressions (Erman & Warren, 2000; Howarth & Howarth, 1998). In the realm of psycholinguistics and linguistics, idioms have received a fair amount of attention; it has been investigated how idiomatic expressions are processed and represented both in the speakers' first (L1) and second language (L2) lexicons.

Empirical studies have shown the very robust finding that idioms are processed more quickly than non-idiomatic matched literal expressions by native speakers (Conklin & Schmitt, 2012; Tabossi, Fanari, & Wolf, 2009). Along similar lines, there are many studies showing quantitative differences between the processing of idiomatic vs. non-idiomatic expressions in the bilingual domain, with idiomatic language enjoying a processing advantage over non-idiomatic language. This advantage has been observed through reaction time tasks (e.g., Conklin & Schmitt, 2008; Jiang & Nekrasova, 2007; Wolter & Gyllstad, 2011; Wolter & Gyllstad, 2013; Wolter & Yamashita, 2014; Yamashita & Jiang, 2010), self-paced reading (Cieślicka, 2011; Conklin & Schmitt, 2008) cued-recall tasks (Yeganehjoo & Yap, 2009; Yeganehjoo, Yap, Abdullah, & Tan, 2012); divided visual field paradigm (Cieślicka, 2013; Cieślicka & Heredia, 2011), and eye movement recordings (Heredia, Olivares, & Cieślicka, 2014; Siyanova-Chanturia, 2013; Siyanova-Chanturia, Conklin, & Schmitt, 2011; Siyanova-Chanturia, Conklin, & van Heuven, 2011; Underwood, Schmitt, & Galpin, 2004). The differences between the processing of idiomatic and non-idiomatic expressions have been accounted for by several theoretical models which explain how idiomatic expressions are comprehended on-line, stored and retrieved for production. In the next sections, a brief overview of the three major models focusing on the processing of idiomatic language is offered.

Non-compositional models of idiomatic processing. Non-compositional models of idiomatic processing assume that idiomatic expressions are independent lexical entries stored in memory as a whole. This idea implies that the figurative meaning of idioms is not directly related to the literal meaning of its individual components. Some of the most representative models included in the non-compositional approach are the *literal processing model* (Bobrow & Bell, 1973), the *lexical representation model* (Swinney & Cutler, 1979), and the *direct access model* (Gibbs, 1980, 2002). Although these models differ as to the way and the timing according to which the meaning of idioms would presumably be retrieved, they all support the claim that the overall idiomatic meaning is semantically independent from the individual semantic meanings of its components (Caillies & Butcher, 2007). According to this approach, the processing advantage of idiomatic expression is explained as due to their entity as single lexical units that are directly accessed.

Compositional models of idiomatic processing. Compositional models propose that idioms vary in terms of their compositionality (The *Phrase-Induced Polysemy Model* by Glucksberg, 2001, 2003; the *Literal Salience Resonance Model* by Cieślicka, 2004). These models share the assumption that the individual meanings of the idiom's components do contribute to the construction of the figurative interpretation of the string. As a consequence, these models reject the idea of holistic retrieval from memory of a lexicalized, pre-fabricated sequence and assume that idiom processing requires on-line semantic and syntactic analyses of the individual components (e.g., Cacciari & Glucksberg, 1991; Cacciari & Tabossi, 1988, 2014; Cieślicka, 2006; Glucksberg, Brown, & McGlone, 1993; Titone & Connine, 1999).

The *Configuration Hypothesis* (Cacciari & Tabossi, 1988), for example, assumes a distributed representation of idioms in the mental lexicon. The main premise of this view is that the idiom is associated to a specific network of words, which are the same that get activated in literal on-line processing. Upon encountering an idiom, the phrase is processed literally until the *idiom key* is reached in the sequence and accessed in the mental lexicon (the idiom key is the word of the idiom that triggers its figurative meaning) (Cacciari & Tabossi, 1988). Only at this point, the individual words included in the idiom are recognized as part of an idiomatic network and the idiomatic meaning is retrieved. According to these models, the repeated use of idioms would be responsible for a higher associative strength between the individual lexical nodes that form the idiom; as a consequence, the advantage shown during the processing of idiomatic expressions would depend on whether such connections are created, allowing a direct retrieval of the idiomatic meaning from the lexicon (Cieślicka, 2006).

Evidence for the compositional models of idiomatic processing comes from the demonstration that compositionality (that is, the degree to which the individual word meanings contribute to the overall figurative meaning) plays a fundamental role in the comprehension of idiomatic expressions. Gibbs and Nayak (1989), for example, showed that adults took more time to decide that non-decomposable idioms were semantically acceptable compared to decomposable idioms (see also Caillies & Butcher, 2007). According to Glucksberg (2001) the facilitation effect observed in comprehension of decomposable idioms is due to the overlap between the result of the on-line literal analysis and the overall figurative meaning; on the other hand, for non-decomposable idioms, the literal analysis does not overlap with the figurative meaning, causing a slowing down of the whole process.

Hybrid models of idioms processing. In between compositional and non-compositional models of idioms processing, the hybrid approach assumes that idioms are both compositional and non-compositional (Titone & Connine, 1999). According to these models, the retrieval of the figurative interpretation arises when a sufficient part of the idiom has been processed literally, until the idiomatic key is reached (similarly to what the Configuration Hypothesis suggests). Thus, the idiomatic key triggers the figurative meaning, whose processing runs in parallel with the literal analysis of the string. This is the main difference between Titone and Connine's Hybrid Model and the Configuration Hypothesis: the former assumes that the literal computation of the idiom is maintained even after the figurative meaning has been retrieved. In the same vein, Cutting and Bock (1997) claimed that although idioms are stored and represented as a whole, they cannot be word-like entries without internal structure.

As claimed in Sprenger, Levelt, and Kempen (2006) hybrid models share the core assumption that idioms are unitary in the sense that they require their own lexical-conceptual entry, and compositional because activation spreads towards the individual lemmas comprised in the idiom; these individual lemmas function as a network when inserted in an idiom, but their functioning is not restricted to it (Sprenger et al., 2006). A recent version of the hybrid models that can be applied both to production and comprehension is the *Superlemma Model* (Sprenger et al., 2006). The superlemma is the holistic and unitary representation of the idiom at the syntactic level, which includes the individual lemmas forming the idiom and their ordering syntactic properties. It is connected both to the idiom's unitary lexical concept as well as to the simple lemmas (the individual components). In this approach, upon encountering an idiom such as *kick the bucket* for comprehension, the lemmas associated to each individual word would be activated twice, by the on-line processing compositional route and as part of the superlemma (non-compositional route) (Carrol & Conklin, 2014). This clearly provides an advantage over the processing of non-idiomatic expressions, which can be processed only via the activation of the lemmas associated to each individual word of the literal expression. However, the activation of the figurative meaning of *kick the bucket* still requires the selection of the superlemma over the activation of the simple lemmas. The superlemma *kick the bucket* (that contains the syntactic constraints that come along with the idiom) competes with the single lemmas "kick = punt" and "bucket = pail" and other related and potentially active superlemmas, such as "meet your maker". According to Sprenger et al., in this competition between co-activated lemmas, the probability of selecting the target superlemma at the lemma level and its underlying concept (at the conceptual level) "is the ratio of the superlemma's degree of activation and the total activation of all lemmas in the lexicon" (Sprenger et al., 2006: 177). At this point, the idiom is recognized as such if its superlemma's activation rises above a certain critical threshold. According to the model, the level of activation of the superlemma will depend on the degree of exposure to it.

Hybrid models in bilingual processing

Yeganehjoo and Yap (2009) explored the hybrid models of idiomatic processing in bilinguals. Interestingly, their results suggest that -similar to other studies with monolinguals- idioms seem to be represented both compositionally and non-compositionally in the bilingual L2 mental lexicon. In their study, they found priming effects in the production of both idiomatic and literal sentences when primed with one of their constituents (identity prime), confirming that the lemmas composing the idiom can be accessed individually. Moreover, the effect of the identity prime was more evident in the case of idiomatic expressions compared to their literal controls, suggesting that the idiomatic expressions are stored and represented as memorized lexical chunks even in the L2 mental lexicon.

Additional evidence for the hybrid models in bilingual language processing comes from Carroll and Conklin (2014); they observed that Chinese-English bilinguals were faster to perform a lexical decision task in their L2 (English) when a target word (i.e., *feet*) was preceded by the initial words of a Chinese transliterated idiom (*draw a snake and add*…, which does not make any sense in English) compared to a target matched control word (*hair*). They explained this pattern by assuming that the initial words of a transliterated Chinese idiom activate the unitary concept of the idiom, which is shared across the bilingual's languages. This concept spreads activation both to its lexical and syntactic properties (designed as the *superlemma* in Sprenger et al., 2006) and to the individual components, making the lexical form of the target (feet) available in the L1 or directly in the L2 (if a sufficiently strong connection has been created across languages). Since the L1 form is a translation equivalent of the target presented, facilitation for the English word "feet" is observed in whatever way.

A critical factor that influences the processing of idiomatic sentences by bilinguals is the L1/ L2 congruency between idiomatic expressions. Congruent idioms are idiomatic expressions whose word-by-word translation is felicitous (i.e., *to break someone's heart* = *romperle el corazón a alguien,* in English and Spanish, respectively). On the contrary, incongruent idioms are expressions whose word-by-word translation is not feasible (i.e., the English idiom *To kick the bucket* and its Spanish translation *Estirar la pata,* whose literal meaning is *To stretch one's leg*). Overall, according to hybrid models, the cross-linguistic overlap between the individual constituents and the superlemma representing the idiomatic expression is crucial for predicting a processing advantage in idiomatic vs. non-idiomatic expressions (i.e., Bortfeld, 2003; Caillies & Butcher, 2007; Gibbs & Nayak, 1989). In other words, in the case of congruent idioms (i.e., the English form "you broke my heart" and the Spanish translation equivalent "me rompiste el corazón") the translation would be facilitated, since the individual lexical entries of the idiomatic expressions are shared across languages (break = romper, heart = corazón), along with the idiomatic meaning of the sentence (you hurt me). In contrast, when an English incongruent idiom (*kick the bucket*) has to be translated into Spanish (*estirar la pata*), the idiomatic meaning (to die) would foster the activation of the proper, idiomatic lexical entries in Spanish (estirar, pata) which would compete with those associated to the translation of the independent, literal lexical units of the English idiom (kick = patear, bucket = cubo). Therefore, the advantage in idiomatic processing relative to literal language would be weaker when incongruent vs. congruent idioms are considered.

In support of these predictions, there is empirical evidence showing that the facilitation effect associated to the processing of idiomatic expressions in bilinguals depends on the congruency between the L1 and the L2 (Wolter & Gyllstad, 2011, 2013; Wolter & Yamashita, 2014). To illustrate, Wolter and

Gyllstad (2011) presented a verb prime to English native speakers and Swedish/English (L1/L2) bilinguals and observed whether it was more likely to facilitate recognition of a noun target if the resulting verb + noun idiomatic form was congruent (i.e., *to join club*) versus incongruent (i.e., *to throw party*) between the two languages considered. Significantly faster reaction times (RTs) were observed to target words that were primed with words that formed congruent and incongruent idiomatic expressions relative to a baseline condition. However, the processing of congruent expressions was faster relative to the processing of incongruent idiomatic expressions. Thus, idiomatic processing depends on the similarity of these expressions across languages (for other congruency effects in bilingual comprehension and production of idioms, see Irujo, 1986, 1993; Wolter & Gyllstad, 2013; Yamashita & Jiang, 2010).

Idiomatic processing and bilingual experience

As mentioned above, an additional assumption of the hybrid models that is of interest in the present study is that the access to the idiomatic superlemmas depends on the degree of exposure to the idiomatic expressions. Carrol and Conklin (2014) suggested that stronger associative links in the idiomatic network, that promote direct and faster access to the superlemmas, are created through frequency of encounters. In fact, there is evidence that only proficient L2 speakers can attain the same advantages than native speakers in the processing of idiomatic expressions, due to a greater exposure to idiomatic meanings (Isobe Yukari, 2011; Jiang & Nekrasova, 2007). For example, in their study with Chinese bilinguals, Carrol and Conklin (2014) found shorter RTs as a result of increased number of years studying English, suggesting that increased exposure can lead to more efficient access to L2 idiomatic forms. That is, bilinguals might be able to use the direct access route (the superlemma) only when high proficiency levels are achieved and strong and stable associations are formed between the nodes (the individual lemmas) that compose the idiom.

This idea unlocks the possibility that different experiences in bilingualism might differentially affect the strength of the associations within the idiomatic network and, thus, performance in processing and translating idiomatic expressions. This point is explored further in the present study, by taking into account different experiences in bilingualism (professional translators vs. untrained bilinguals).

Untrained bilinguals and trained professional translators represent two different types of exposure to the linguistic experience, which have been defined as natural vs. professional translation (Harris & Sherwood, 1978). Professional translators are extensively trained in accessing lexical information in their two working languages, as to access this lexical information in a relatively automatic way (Padilla, Bajo, & Macizo, 2005). In fact, training in bilingual tasks speeds up and automatizes comprehension and retrieval processes (de Groot & Christoffels, 2006); moreover better translation performance is associated to faster reaction times in lexical retrieval and word translation tasks (Christoffels, de Groot, & Kroll, 2006; Christoffels, de Groot, & Waldorp, 2003). As a consequence, we assumed that because of their training in lexical retrieval and their need to correctly and efficiently perform translation tasks, translators would have formed stronger links between the nodes composing idiomatic expression and would retrieve more efficiently both the mapping of the idioms to the figurative meaning in the same language (comprehension process) and the mapping of the figurative meaning to the L2 idiomatic linguistic form (target language production/ translation process).

The present study

We wanted to explore the predictions of the hybrid models regarding a possible differential access to the superlemmas depending on whether the bilinguals' experience fosters stronger associative links among the idiom' s constituent lemmas. Since we wanted to explore both the L1 idiom comprehension phase and the L1 to L2 mapping between the figurative meanings, we employed a translation task where we manipulated the cross-language congruency between idiomatic expressions, and compared their comprehension relative to matched non-idiomatic, control expressions. Our hypothesis was that professional translators would be able to map L1 and L2 idiomatic expressions (at the superlemma level) in a relatively more automatic and efficient way than untrained bilinguals, due to their extensive practice in acquiring the specific sub-skills involved in the translation process.

In order to measure the degree of automaticity in the processing of the to-be-translated idioms, we used a concurrent dual task. Thus, we asked participants to detect a tone (by pressing the space bar) while processing the visually presented sentences with instructions to understand and then translate them. The basic idea underlying the use of the tone detection methodology is that the more cognitive resources are needed to process the idiomatic expression, the fewer resources would be left for processing the tone. Concretely, the assumption is that because the speech planning phase for translation demands computational resources, when these planning processes are initiated, less free resources would be available in the cognitive system to face the concurrent tone detection task. By consequence of this fact, the latencies of correct tone detections will be slower (Ladefoged & Broadbent, 1960). Following the logic of this methodology, RTs to the tone will provide an index of the cognitive resources needed to process the different types of idioms (congruent and incongruent) by bilinguals and professional translators, and the ease with which this task is accomplished (i.e., automaticity).

Regarding the processing of idiomatic expressions, and based on hybrid models, we predict an overall idiom superiority effect (over matched non-idiomatic language) resulting in the allocation of fewer cognitive resources. This would imply that the different components of an idiom are bound together by one common entry in the mental lexicon (Sprenger et al., 2006) and activated twice. According to Sprenger et al. the activation of each idiom's element will result in a spreading activation flow towards all the remaining elements via the superlemma, resulting in faster availability of the idiomatic sequence. However, for non-idiomatic expressions (matched control expressions) no such common representation exists (Sprenger et al., 2006), thus a greater amount of cognitive resources might be needed in this case. If, as suggested by the hybrid models, the binding between the individual lemmas composing the idiom depends on the bilinguals' experience, we might expect differences between trained and untrained bilinguals with trained bilinguals showing a more efficient access to superlemmas. In addition, if we consider that the processing of congruent idioms, whose independent lexical units are shared across languages, is faster and more automatic than the processing of incongruent idioms (Wolter & Gyllstad, 2011), the differences between bilinguals and translators should be more evident for those idiomatic expressions whose processing is more demanding (incongruent idioms).

EXPERIMENT 1

Method

Participants. Seventeen Spanish/ English bilinguals (12 women and 5 men) and sixteen professional Spanish/ English translators (10 women and 6 men) participated in the present study. The bilinguals did not have experience in professional translation while the translators had a minimum of three years' experience working as in-house translators. All the participants were paid for their participation. A prerequisite for participation in the study was to have attained the level C2 in English, as established by the **Common European Framework of Reference for Languages.** The bilinguals' mean age was 27.82 (range from 19 to 35). Translators' mean age was 29.75, ranging from 26 to 33. Before performing the actual experiment, participants were asked to complete a language proficiency questionnaire on reading, writing, listening, and speaking in Spanish (L1) and English (L2) (adapted from Li, Sepanski, & Zhao, 2006; see Chapter VIII, Appendix A). Bilinguals and translators did not differ in their L1 and L2 proficiency (all *p*s > .05). They were also compared on AoA (i.e. Age of active onset of bilingualism, definition by Luk, De Sa, & Bialystok, 2011). No differences in AoA were observed between bilinguals and translators, $t(31) = -0.06$, $p = .94$, $d = -0.02$. Participant's characteristics are reported in Table 1.

■ **Table 1**

Characteristics of participants in the study

	Experiment 1		Experiment 2
	Bilinguals	*Translators*	*Translators*
Age (years)	27.82 (5.29)	29.75 (2.51)	27.93 (2.81)
AoA of the L2	6.76 (2.77)	6.81 (0.91)	7 (1.46)
Living in L2 speaking countries (months)	11.82 (9.42)	11.81 (10.89)	11.06 (7.68)
	Language Proficiency Questionnaire		
L1 Speech comprehension	9.64 (0.99)	9.81 (0.40)	9.81 (0.40)
L1 Writing proficiency	9.35 (1.05)	9.56 (0.62)	9.5 (0.63)
L1 Speech fluency	9.58 (0.71)	9.56 (0.72)	9.5 (0.73)
L1 Reading proficiency	9.64 (0.86)	9.75 (0.44)	9.75 (0.44)
L2 Speech comprehension	9.17 (1.07)	9.12 (0.88)	9.18 (0.75)
L2 Writing proficiency	9.05 (1.08)	8.93 (0.92)	8.87 (0.80)
L2 Speech fluency	9.52 (0.62)	9.12 (0.95)	9.06 (0.92)
L2 Reading proficiency	9.52 (0.71)	9.25 (0.44)	9.25 (0.77)

Note. Mean scores for the self-evaluation questionnaire on L1 (Spanish) and L2 (English) competence. Self-report ratings for L1 and L2 ranged from 1 to 10, being 1 "not fluent" and 10 "very fluent". Standard deviations are reported in brackets.

Design and Materials. A mixed 2 x 2 x 2 design was used. The factor Group (Bilinguals vs. Translators) was manipulated between subjects. The variables Type of Phrase (TP, being the levels of this variable: idioms vs. controls) and Type of Idiom (TI, being the levels: incongruent vs. congruent idioms) were manipulated within-subjects. A total of 64 idioms (32 incongruent, 32 congruent), 64 controls (32 controls for the incongruent idioms and 32 controls for the congruent idioms) and 32 filler sentences (16 non-idiomatic and 16 idiomatic sentences other than the idioms used as experimental material) were selected for the current study (extracted from Savaiano & Winget, 1995). All the material was presented in English for translation into Spanish (see Figure 1 for examples and Chapter VIII, Appendix C for complete stimulus material).

■ *Figure 1.* **Experimental material: examples for each condition**

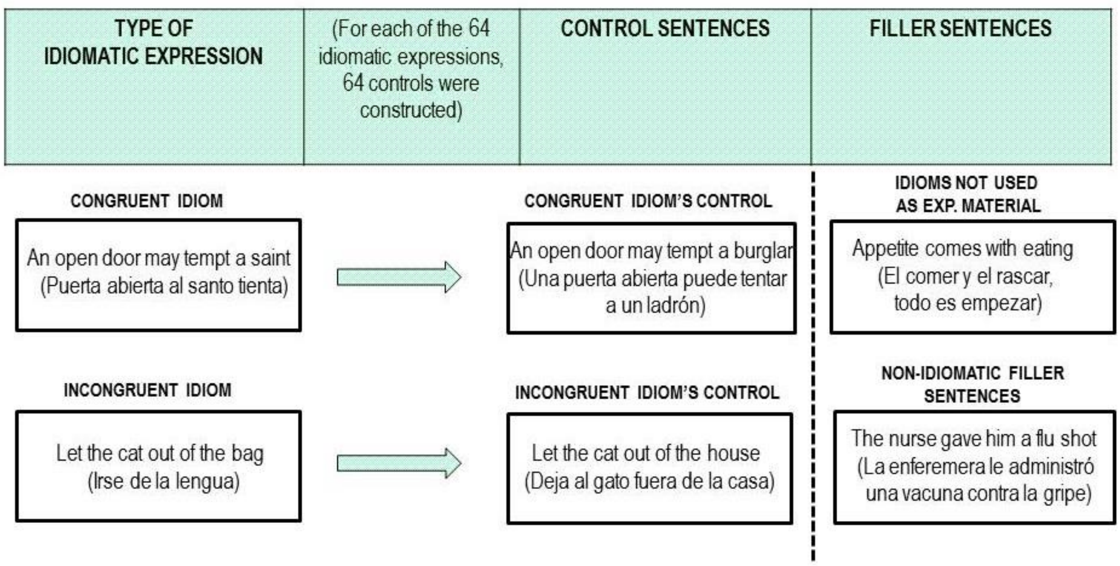


Figure 1. Example of congruent and incongruent idioms and their control sentences. Thirty-two congruent and thirty-two incongruent idioms (for a total of sixty-four idioms) were used as experimental material. For each idiom, control sentences were created. Filler sentences included idioms not used as experimental material and non-idiomatic filler sentences.

The main feature of incongruent idioms was that no word-by-word translation was possible to render their meaning in the L2 (i.e., the translation of the incongruent idiom *To kick the bucket* is *Estirar la pata* (To stretch one's leg). A word-by-word translation (*Patear el cubo)* would be incorrect. On the other hand, a word-by-word translation should be performed in the case of congruent idioms (i.e., *To break someone's heart* = *Romperle el corazón a alguien*). For each of the 64 idiomatic expressions, the controls were constructed in such a way that the idiomatic sentences lost their figurative meaning (i.e., for the idiom *To call the shots*, the control phrase was *To call the employees*).

The idiomatic expressions and the control material employed in the experiment were evaluated through two norming studies. A first norming study was conducted in order to norm the idioms on a number of different characteristics within the Spanish/English bilingual population. The norming study was conducted following Cieślicka's (2011) study. After finishing the main experiment, the same participants who performed the experimental task (Spanish/ English bilinguals) were asked to rate the idioms across six different judgment tasks. The parameters considered were: familiarity, predictability, compositionality, literality, transparency/ opaqueness and congruency/ incongruency between languages. As reported in (Cieślicka, 2011), familiarity refers to how well known an idiom is; a 1 to 7 scale was employed, where 1 indicated that they were not familiar with the idiom and 7 that they were totally familiar with the idiom (see Table 2 for a summary of the norming study).

■ **Table 2**

Mean scores for the judgment tasks comprised in the norming study

	Congruent Idioms	*Incongruent Idioms*
Familiarity	5.85	5.50
Predictability	5.32	4.91
Compositionality *	4.94	3.65
Literality *	5.55	3.39
Transparency *	5.85	4.23
Cross-language Congruency *	6.64	2.28

Table 2. Mean scores for the judgment tasks comprised in the norming study. The ratings ranged from 1 to 7 where 1 indicated a low value and 7 a high value. Significant differences are signalled with an asterisk.

The 64 idioms used in the experiment were all familiar; a *t*-test analysis was performed comparing the two types of idioms (congruent and incongruent) and no differences in familiarity were observed between the two types of idioms, $t(62) = 1.44$, $p = .15$, $d = 0.37$.

Predictability refers to the probability of completing the missing last word of a phrase idiomatically, given its beginning words (Cieślicka, 2011); participants were asked to rate predictability using a 1 to 7 scale, where 1 indicated low predictable and 7 high predictable idioms. The Predictability rates for the congruent and incongruent idioms did not differ, $t(62) = 1.41$, $p = .16$, $d = 0.36$.

Compositionality refers to how semantically close are the literal meanings of the idiom's components to the overall figurative sense (Cieślicka, 2011). In the compositionality rating task, 1 indicated that the idiom was non-decomposable and that there was no relation between the meaning of its constituents and its idiomatic sense (Cieślicka, 2011) (e.g., *To kick the bucket*). On the other hand, 7 indicated that the idiom was decomposable and there was a close semantic correspondence between its constituents ant the overall figurative sense (Cieślicka, 2011) (e.g., *To play with fire*). Significant differences were observed between congruent and incongruent idioms, $t(62) = 3.76$, $p < .001$, $d = 0.96$; participants tended to rate congruent idioms as decomposable and incongruent idioms as non-decomposable.

Literality refers to the degree to which an idiom can be interpreted literally. In the literality judgment task, participants were given examples of idioms with literal plausible interpretation (e.g., *To wear the pants*) and idioms with no plausible literal interpretation (e.g., *To rain cats and dogs*). Then, they were asked to rate the idioms on a 7 point scale, where 1 indicated that the idiom did not have a plausible literal interpretation and 7 that the idiom has a plausible literal interpretation. Significant differences were observed when comparing congruent and incongruent idioms on literality, $t(62) = 7.77$, $p < .001$, $d = 1.98$. The congruent idioms were rated as having, overall, a more plausible literal interpretation than incongruent idioms.

Transparency/ opaqueness refer to the degree to which it is possible to guess the meaning of the idiom from the phrase (Cieślicka, 2011). In this task, 1 indicated that the idiom was opaque and its meaning could not be guessed (Cieślicka, 2011) (e.g., *To let the cat out of the bag*) and 7 indicated that the idiomatic meaning could be guessed (Cieślicka, 2011) (e.g., *To have one foot in the grave*). As to Transparency, significant differences between the rates for congruent and incongruent idioms were observed, $t(62) = 5.23$, $p < .001$, $d = 1.33$. Congruent idioms were rated as more transparent than incongruent idioms.

Congruency between languages refers to the degree to which L1 and L2 translation equivalents overlap at the superlemma level. Participants were provided with examples of congruent idioms (e.g., *To break someone's heart* = *Romperle el corazón a alguien*); examples of incongruent idioms were also provided (*To hit the ceiling* =*Perder los estribos*) and asked to rate the cross-language congruency on a 1 to 7 point Likert scale, where 1 indicated that the idiom was incongruent and 7 that was congruent). The norming task confirmed that the experimental material was well classified according to the congruency parameter. Significant differences were observed between congruent and incongruent idioms, $t(62) = 20.18$, $p < .001$, $d = 5.13$. The congruent idioms were judged as forms whose word-by-word translation between languages was felicitous, while the incongruent idioms were rated as forms whose word-by-word translation between languages is not felicitous.

In a second norming study, 20 English native speakers were asked to evaluate the control sentences indicating their level of comprehension for each statement on a 1 to 7 Likert scale, being: 1 = I do not comprehend; 2 = Low comprehension; 3 = Slight comprehension; 4 = Neutral; 5 = Moderate comprehension; 6 = Good comprehension; 7 = Very good comprehension. A *t*-test analysis was performed comparing the comprehension data for the congruent vs. incongruent controls, and no differences were observed, $t(62) = 0.72$, $p = .23$, $d = 0.19$.

In the current experiment, 4 blocks of sentences were created. Each block consisted of 8 between-languages incongruent idioms, 8 congruent idioms, 8 controls for the incongruent idioms, 8 controls for the congruent idioms, 8 non-idiomatic filler sentences and 8 idiomatic filler sentences. The presentation of the 4 blocks was counterbalanced across participants in such a way that one participant never received the idiomatic sentence together with its corresponding derived unit throughout the experiment. At the same time, we made certain that each sentence was presented an equal number of times both in its idiomatic and control form across the participants. Hence, each participant received 2 blocks (96 sentences). The sentences within each block were randomly presented.

A dual task condition was created by placing a tone on one word of each experimental sentence. The tone stimulus duration was 250 ms. It was used in order to observe the level of availability of free cognitive resources in the retrieval of the translation units. The tone sound was placed randomly so as to avoid predictability of the tone position across trials.

Procedure. The experiment was run using E-prime experimental software, 2.1 version (Schneider, Eschman, & Zuccolotto, 2002). Participants were tested individually. They were informed that they had to read sentences in English and, simultaneously, to detect a tone sound that would randomly appear on one of the words included in each sentence, by pressing the space bar with their dominant hand when hearing the tone. Finally, they were told that, after each sentence was displayed, they had to translate orally the whole string into Spanish. Participants were not informed about the presence of idioms. In addition, they were told that the message "Translate" would appear at the end of each sentence, indicating that they had to start the translation into L1.

Participants seated approximately 60 cm from the computer screen. Stimuli were presented in lower-case black letters (Courier New font, 18 point size) on a white background. Each block began with the presentation of one fixation cross displayed at the centre of the monitor for 300 ms. In the first block, right after the fixation crosses offset, 3 practice trials with sentences that were not used in the main experiment were presented to train participants to perform the task optimally. The words displayed appeared in the position as the fixation cross was located. The sentences were presented visually on the computer screen, word-by-word, through a rapid serial visual presentation paradigm. Each word was presented during 300 ms.

Reaction times to tone detections were recorded using E-prime software and the tokens of translations produced were recorded using an ICD-SX1000 Sony Digital Voice Recorder for later analyses.

Results and Discussion

The data for one bilingual was eliminated from the Reaction Time (RT) analyses because the participant had no correct hits in response to the incongruent idioms. We first report the results for tone detection RTs, followed by analyses focused on performance in translation. Analyses of variance (ANOVAs) were performed with participants and items as random factors (F_1 and F_2, respectively).

Tone detection RTs

These analyses focus on the RTs of correct hits in response to the presence of the auditory tone stimulus while reading for translation. The percentage of tones correctly detected was 91.73%. The RTs were analyzed using a 2 x 2 x 2 mixed design ANOVA with Group (bilinguals vs. translators), Type of phrase (TP: idioms vs. controls), and Type of idiom (TI: congruent vs. incongruent) as factors. We observed a main effect of Type of Idiom (TI) by subjects, $F_1(1, 30) = 4.68$, $p = .03$, $\eta_p^2 = .13$, but not by items, $F_2(1, 224) = 1.03$, $p = .30$, $\eta_p^2 = .004$. The main effect of "Type of Phrase" (TP) was not significant $F_1(1, 30) = 0.07$, $p = .33$, $\eta_p^2 = .03$, and $F_2(1, 224) = 2.33$, $p = .12$, $\eta_p^2 = .01$. The main effect of "Group" was not significant by subjects, $F_1(1, 30) = 1.27$, $p = .26$, $\eta_p^2 = .04$, but was significant by items, $F_2(1, 224) = 4.05$, $p = .04$, $\eta_p^2 = .01$.

The two–way interaction between TP x Group was not significant, $F_1(1, 30) = 1.79$, $p = .19$, $\eta_p^2 = .05$, and $F_2(1, 224) = 1.20$, $p = .27$, $\eta_p^2 = .005$. The interaction between TI x TP was not significant by subjects, $F_1(1, 30) = 1.08$, $p = .30$, $\eta_p^2 = .03$, but was significant by items, $F_2(1, 224) = 4.37$, $p = .03$, $\eta_p^2 = .01$.

The interaction between TI and Group was significant by subjects, $F_1(1, 30) = 5.33$, $p = .02$, $\eta_p^2 = .15$, but not by items, $F_2(1, 224) = 0.38$, $p = .53$, $\eta_p^2 = .001$.

The three-way interaction TI x TP x Group was significant both by subjects, $F_1(1, 30) = 4.41$, $p = .04$, $\eta_p^2 = .12$, and by items, $F_2(1, 224) = 4.59$, $p = .03$,

η_p^2 = .20. This interaction was further analyzed in order to evaluate possible differences between bilinguals and translators depending on the type of idiom (congruent vs. incongruent).

The processing of congruent idioms. The ANOVA performed on the RTs for the processing of congruent material did not reveal a significant effect of Group, $F_1 < 1$, $F_2(1, 121) = 1.26$, $p = .26$, $\eta_p^2 = .01$. The main effect of TP was significant, $F_1(1, 31) = 3.54$, $p = .05$, $\eta_p^2 = .10$, $F_2(1, 121) = 8.53$, $p = .004$, $\eta_p^2 = .06$. (see Figure 2). The interaction TP x Group was not significant, F_1 and $F_2 < 1$. Means (with standard deviations in parenthesis) for congruent idioms and their controls in bilinguals were 405.87 ms (83.94) and 444.97 ms (148.91); for translators they were: 402.26 ms (75.55) and 436.79 ms (125.14). The lack of interaction suggests that for congruent idioms the usual idiom superiority was present for both bilinguals and translators with RTs for the secondary task faster when presented with idiomatic expressions than with their controls.

■ *Figure 2.* **Mean RT for correct tone detection and correct translations in Congruent, Incongruent idioms and Controls, as a function of Group**

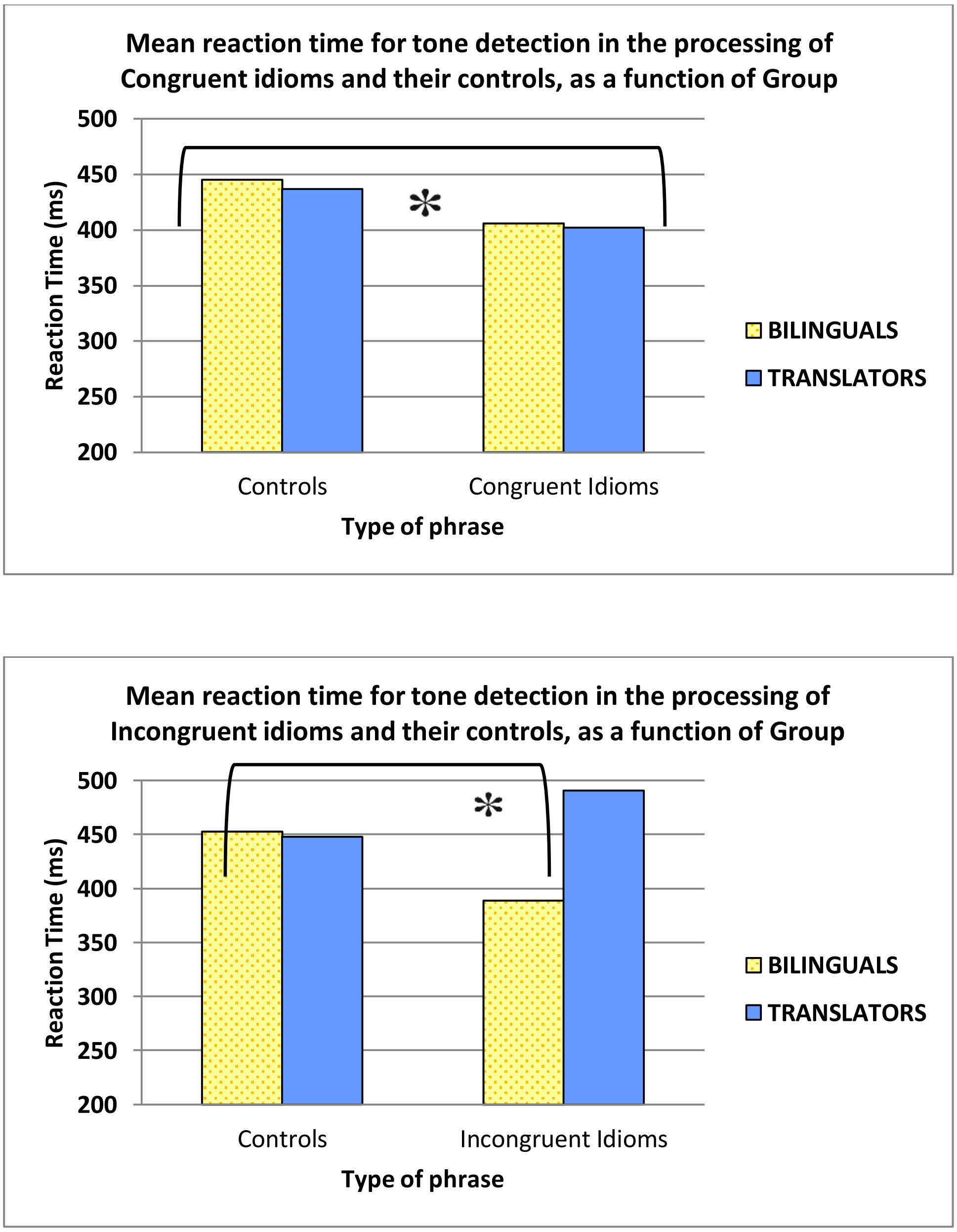


Figure 2. Results obtained in Experiment 1. Mean reaction time for tone detection by bilinguals and translators during the processing of Congruent Idioms and their Controls (upper panel) and Incongruent Idioms and their Controls (bottom panel). On the horizontal axis, Type of Phrase (critical vs. control), on the vertical axis, Reaction Times (milliseconds) are presented.

The processing of incongruent idioms. In the ANOVA for the processing of incongruent idioms and their controls the effect of Group was not significant, $F_1(1, 30) = 2.97$, $p = .09$, $\eta_p^2 = .09$, and $F_2(1, 103) = 2.68$, $p = .10$, $\eta_p^2 = .02$; neither was significant the TP effect, $F < 1$. A significant TP x Group interaction was observed, $F_1(1, 30) = 4.93$, $p = .03$, $\eta_p^2 = .14$, $F_2(1, 103) = 4.05$, $p = .05$, $\eta_p^2 = .03$. Planned comparisons were performed to compare the two groups in incongruent idioms and their controls. The difference between the two groups was not significant in the control condition (F_1 and $F_2 < 1$). Means for controls (with standard deviation in parenthesis) were 452.89 ms (142.99) for bilinguals and 448.15 ms (114.41) for translators. Importantly, the difference between the two groups was significant in the incongruent idiom condition, $F_1(1, 30) = 5.99$, $p = .02$, $\eta^2 = .16$, $F_2(1, 103) = 5.81$, $p = .02$, $\eta^2 = .05$. The bilingual group was faster in the secondary task while processing incongruent idioms ($M = 388.76$ ms, $SD = 116.15$) compared to the translators ($M = 490.45$ ms, $SD = 118.75$).

The results obtained in the analyses of the tone detection RTs showed that bilinguals and translators did not differ in the processing of congruent idioms. The only effect observed for this type of material was a general speed-up for both groups in the processing of congruent idioms compared to their controls. Both groups seemed to involve similar amounts of cognitive resources when retrieving the translation equivalent of congruent idioms as indexed by their faster RTs to the tone in this condition. However, compared to the translators, bilinguals showed significantly faster RTs in response to the secondary task when processing incongruent idioms; this difference was not shown in the case of the incongruent idioms' control sentences.

Accuracy: translation errors in correct tone detections

Accuracy analyses focused on the translation errors committed in correct tone detections. For these analyses, we considered as errors all responses that did not include the correct translation of the idiom (*Kick the bucket* had to be translated as *Estiró la pata* to be considered a correct response). Thus errors included: Don't know responses, not available, refusal, nonsense translations, misinterpretation, incorrect meaning, loss, omission, word-by-word translation (idioms translated as literal speech), over-translation (literal speech translated as idioms), but also paraphrases of the idiom (see Delisle, Lee-Jahnke, & Cormier, 1999, for an extensive review of translation errors). Therefore, the classification of correct translations in the current analyses was very restrictive.

A 2 x 2 x 2 mixed designed ANOVA was performed, introducing Group (bilinguals vs. translators), Type of phrase (TP: idioms vs. controls), and Type of idiom (TI: congruent vs. incongruent) as factors. The main effect of Type of idiom was significant, $F_1(1, 31) = 65.23$, $p < .001$, $\eta_p^2 = .67$, $F_2(1, 248) = 33.30$, $p < .001$, $\eta_p^2 = .12$. The interaction between TP x Group was significant, $F_1(1, 31) = 31.44$, $p < .001$, $\eta_p^2 = 0.50$, $F_2(1, 248) = 19.70$, $p < .001$, $\eta_p^2 = .07$, as well as the TI x TP interaction, $F_1(1, 31) = 105.25$, $p < .001$, $\eta_p^2 = .77$, $F_2(1, 248) = 65.89$, $p < .001$, $\eta_p^2 = .21$. None other main effects or interactions were significant (all *p*s > .05). Further analyses were performed to explore the interactions observed in the main analysis. As done in the tone detection analyses, we examined possible differences between bilinguals and translators depending on the type of idiom (congruent vs. incongruent).

Errors in congruent idioms. The ANOVA for the congruent idioms and their controls was carried out introducing the TP and Group as factors. The analysis revealed a significant TP x Group interaction, $F_1(1, 31) = 15.72$, $p < .001$, $\eta_p^2 = .34$, $F_2(1, 124) = 8.72$, $p = .004$, $\eta_p^2 = .06$. Planned comparisons yielded no significant differences between the two groups in the amount of errors produced in the translation of congruent idioms' controls, $F_1(1, 31) = 3.93$, $p = .06$, $\eta^2 = .11$, $F_2(1, 124) = 2.93$, $p = .09$, $\eta_p^2 = .02$. The amount of translation errors produced for these sentences was: ($M = 36\%$, $SD = 16\%$) for the bilingual group and ($M = 48\%$, $SD = 17\%$) for the translators (see Figure 3). On the other hand, the differences were significant with regard to the translation of congruent idioms, $F_1(1, 31) = 5.01$, $p = .03$, $\eta^2 = .14$, $F_2(1, 124) = 6.07$, $p = .01$, $\eta_p^2 = .05$, the amount of translation errors was significantly lower in the group of translators (M = 12%, SD = 8%) relative to the group of bilinguals (M = 24%, SD = 20%).

■ *Figure 3.* **Mean percentage of translation errors**

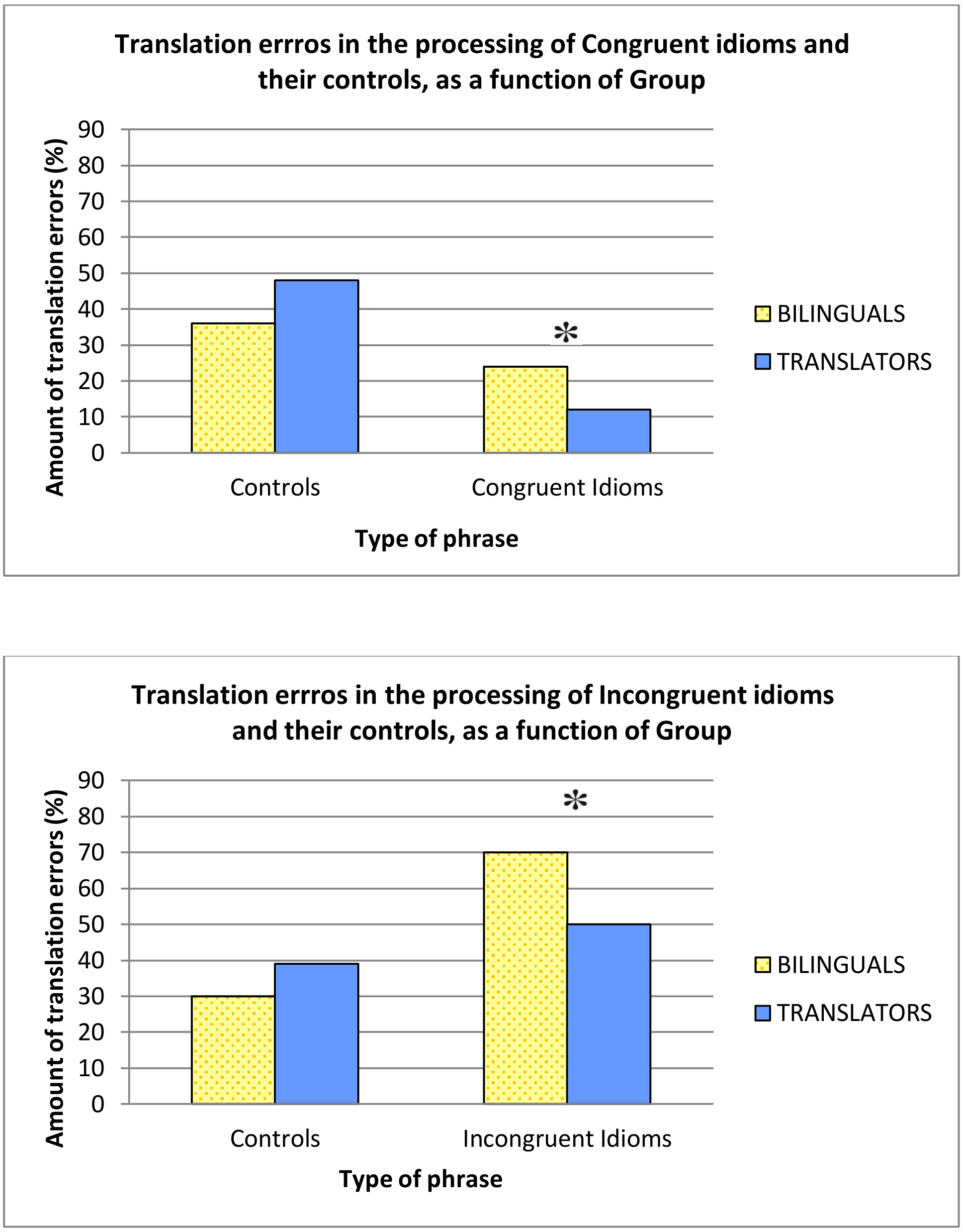


Figure 3. Results obtained in Experiment 1. Translation errors during the processing of Congruent Idioms and their Controls (upper panel) and Incongruent Idioms and their Controls (bottom panel). On the horizontal axis, Type of Phrase, on the vertical axis, Amount of Translation Errors (percentages) are presented.

Errors in incongruent idioms. As for the analysis of the incongruent idioms and their controls, the factors TP (incongruent idioms vs. controls) and Group were introduced. The analysis yielded a significant TP x Group interaction, $F_1(1, 31) = 15.12$, $p < .001$, $\eta_p^2 = .32$, $F_2(1, 124) = 10.99$, $p < .001$, $\eta_p^2 = .08$. Planned comparisons did not show differences between the two groups in the translation of control sentences, $F_1(1, 31) = 2.77$, $p = .11$, $\eta^2 = .08$, $F_2(1, 124) = 1.14$, $p = .29$, $\eta^2 = .00$ (M = 30%, SD = 16% for the bilingual group and M = 39%, SD = 14% for the translators) (see Figure 2). However, significant differences between the two groups were observed in the amount of translation errors produced while translating incongruent idioms, $F_1(1, 31) = 12.06$, $p < .001$, $\eta^2 = .28$, $F_2(1, 124) = 13.10$, $p < .001$, $\eta^2 = .10$. The bilinguals were characterized by a higher level of errors (M = 70%, SD = 15%) compared to the translators (M = 50%, SD = 16%) (see Figure 3).

Therefore, as far as accuracy in translation is concerned, translators outperformed bilinguals in the amount of correct translations produced both for congruent and incongruent idioms, since bilinguals showed significantly more translation errors for both types of idioms. This pattern was only observed in the case of idioms, since no significant differences were observed in the amount of translation errors produced in literal speech (congruent and incongruent idioms' controls).

Accuracy: semantic translations

Considering that the differences between the two groups were strikingly evident in terms of accuracy when they translated incongruent idiomatic expressions, we conducted further analyses to capture the locus of the effect. In the previous analyses, we only considered as correct responses those cases in which participants were able to access the correct lexical and syntactic form of the idioms in L1. In the present analyses, we wanted to capture whether they were able to access the correct figurative meaning of the idiom, including those cases in which its lexical and syntactic forms were not accessible. For this reason, we considered as correct translations those for which the idiomatic meaning of the idiom was preserved regardless of whether participants produced or not the exact lexical and syntactic form of the idiom in the L1.

In the 2 x 2 x 2 mixed design ANOVA, the main effect of TI was significant, $F_1(1, 31) = 43.07$, $p< .05$, $\eta_p^2 = .58$, $F_2(1, 248) = 24.60$, $p < .001$, $\eta_p^2 = .09$. The interaction between TP x Group was significant, $F_1(1, 31) = 25.56$, $p < .001$, $\eta_p^2 = .45$, $F_2(1, 248) = 16.03$, $p < .001$, $\eta_p^2 = .06$, and the interaction TI x TP was also significant, $F_1(1, 31) = 82.41$, $p < .001$, $\eta_p^2 = .72$, $F_2(1, 248) = 48.60$, $p < .001$, $\eta_p^2 = .16$. None other effects were significant. As done in previous analyses, the effects associated to the processing of congruent and incongruent idioms were analyzed separately.

When participants processed congruent idioms, the TP x Group interaction was significant, $F_1(1, 31) = 17.69$, $p < .001$, $\eta_p^2 = .36$, $F_2(1, 124) = 6.39$, $p = .01$, $\eta_p^2 = .05$. There were no between groups differences in the amount of correct translations for the congruent idioms' controls, $F_1(1, 31) = 2.22$, $p = .14$, $\eta^2 = .06$, $F_2(1, 124) = 2.39$, $p = .12$, $\eta^2 = .01$. The amount of correct translations for the congruent idioms' controls was: M = 48%, SD = 16%, for bilinguals and M = 40%, SD = 13%, for translators (see Figure 4). The two groups did differ as to the congruent idioms, $F_1(1, 31) = 4.40$, $p = .04$, $\eta^2 = .12$, $F_2(1, 124) = 4.11$, $p = .04$, $\eta^2 = .03$. In this condition, translators (M = 75%, SD = 18%) outperformed bilinguals (M = 60%, SD = 23%) in the amount of correct translations produced.

When participants processed incongruent idioms, the TP x Group interaction was significant also, $F_1(1, 31) = 10.33$, $p = .003$, $\eta_p^2 = .25$, $F_2(1, 124) = 10.08$, $p = .002$, $\eta_p^2 = .07$. There were no between groups differences in the case of incongruent idioms' controls, $F_1(1, 31) = 1.70$, $p = .20$, $\eta^2 = .05$, $F_2(1, 124) = 2.93$, $p = .09$, $\eta^2 = .02$, being similar the values for bilinguals (M = 54%, SD = 17%) and translators (M = 47%, SD = 14%) (see Figure 4). The two groups did differ in the amount of correct translations produced for the incongruent idioms, $F_1(1, 31) = 7.86$, $p = .008$, $\eta^2 = .20$, $F_2(1, 124) = 7.71$, $p < .001$, $\eta^2 = .06$. As previously noted for the congruent idioms, translators (M = 42%, SD =18%) also outperformed bilinguals (*M* = 25%, *SD* = 15%) in the amount of correct translations they produced for incongruent idioms.

■ ***Figure 4.*** **Amount of correct semantic translations**

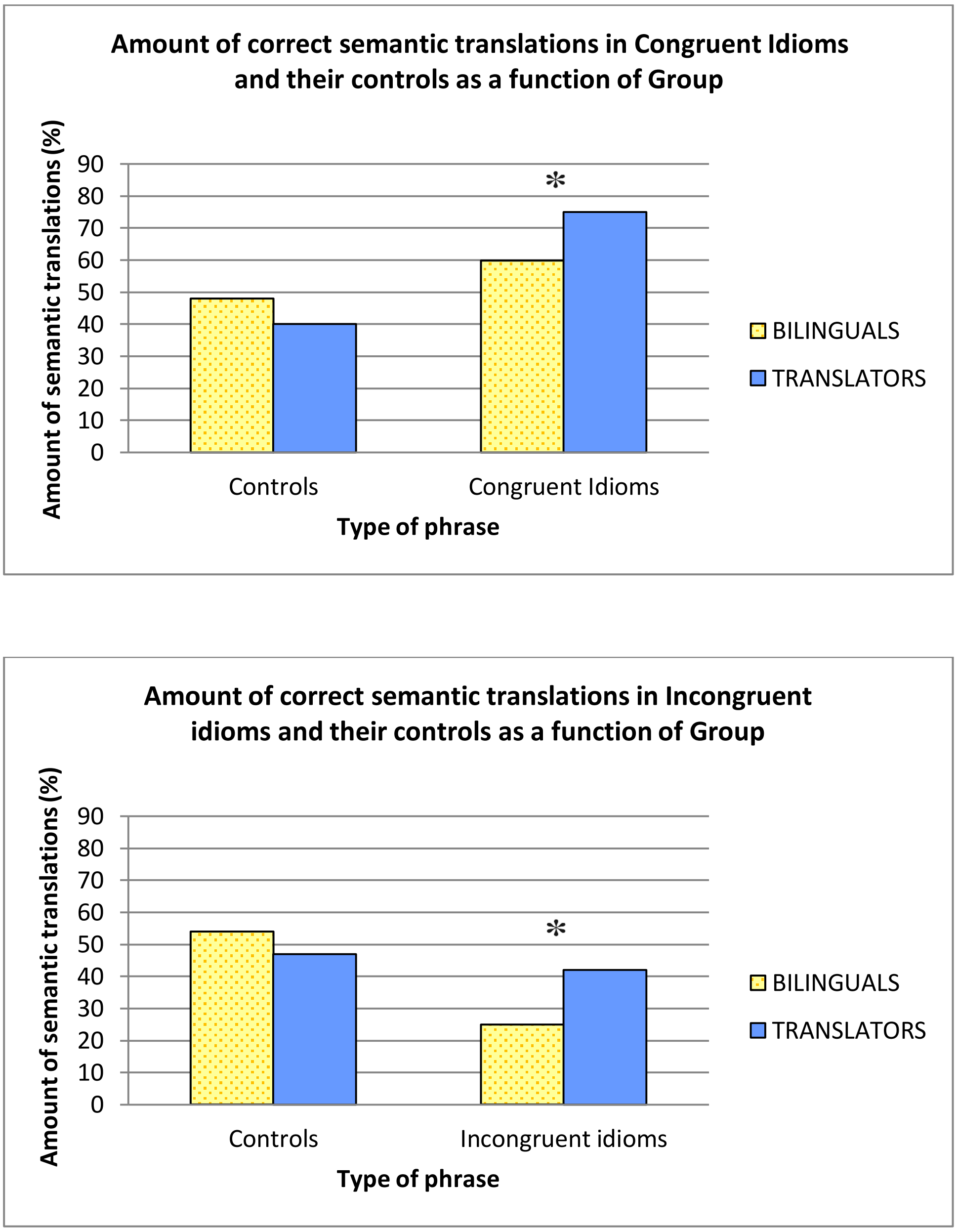


Figure 4. Results obtained in Experiment 1. Semantic performance accuracy by bilinguals and translators during the processing of Congruent Idioms and their Controls (upper panel) and Incongruent Idioms and their Controls (bottom panel). On the horizontal axis, Type of Phrase, on the vertical axis, Amount of Semantic Translation (percentages) are presented.

The results reported above indicate that translators were slower than the bilinguals in the tone detection RT when the tone was placed on incongruent idioms (Figure 1). So far, it has been observed that this pattern of results was not due to an inferior translation competence in the group of translators, since the analysis of both the accuracy in performing the translation task and the number of semantic translations confirmed that the translators outperformed the bilinguals (Figure 3 and 4) and did have access to the superlemma as a whole, both to its linguistic (accuracy analysis) and conceptual entity (semantic translation analysis).

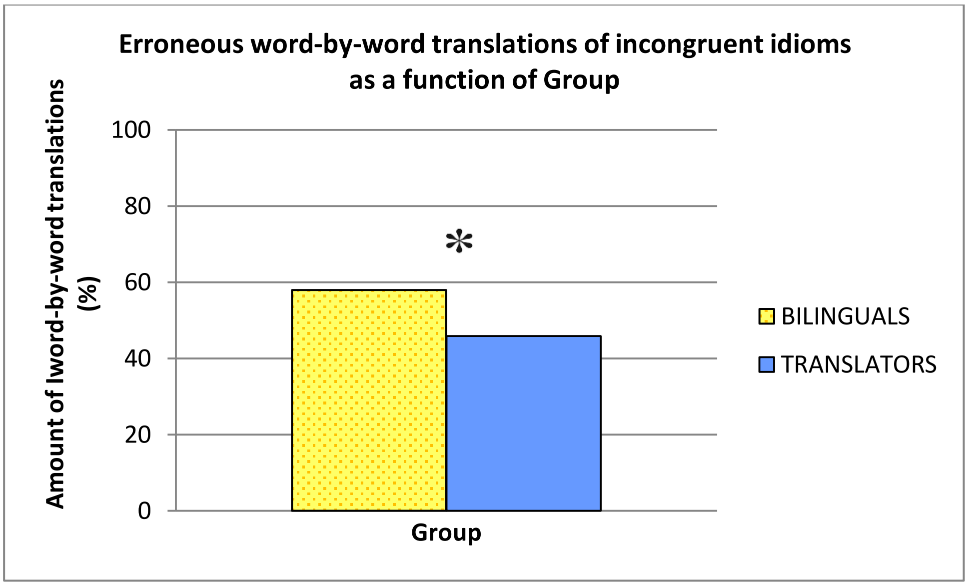
It might be possible that the locus of the differences observed between bilinguals and translators in the availability of cognitive resources might come from the degree to which they activated the superlemma equivalent across languages relative to activation of individual lexical forms in L1 and L2. All participants needed to activate the superlemma equivalents when they translated the idioms correctly. However, when participants committed errors in the translation of incongruent idioms, they might be due to the prevalence of a word-by-word translation (i.e., the use of co-activated individual words in L1 and L2), relative to the correct dominance of the superlemma equivalents across languages.

Erroneous approach to incongruent material

Erroneous word-by-word translations of incongruent idioms

We focused on the amount of incongruent idioms erroneously translated literally (word-by-word translation; i.e., *He came dressed up to the nines* = *Llegó disfrazado a las nueve* instead of *Llegó vestido de punta en blanco*) and performed a one-way ANOVA introducing the Group as factor. We observed a main effect of Group, $F(1, 31) = 4.44$, $p = .04$, $\eta^2 = .12$. The bilinguals experienced significantly more word-by-word translations (M = 58%, SD = 19) compared to the translators (M = 46%, SD = 13%). These results confirmed that, despite involving more cognitive resources to process incongruent idioms (slower RTs to tone detection), translators seem to enjoy a more direct access to the TL translation equivalent at the superlemma level for these idioms, and seemed to adopt a more chunked approach to translation, compared to the word-by-word approach preferred by the bilinguals (see Figure 5).

■ *Figure 5.* Erroneous translations of incongruent material



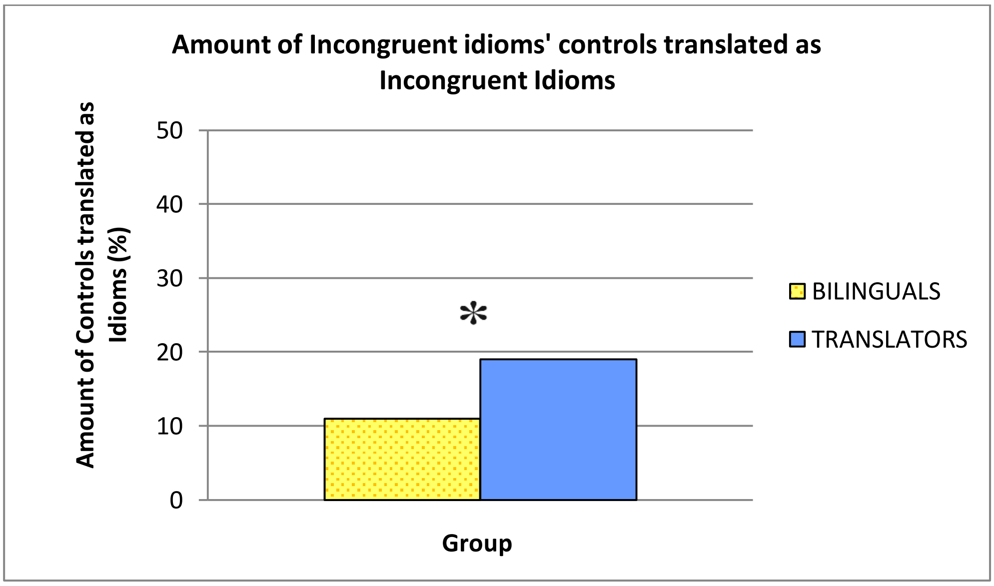


Figure 5. Results obtained in Experiment 1. Upper panel: amount of incongruent idioms erroneously translated literally (word-by-word translation; i.e., *He came dressed up to the nines* = *Llegó disfrazado a las nueve* instead of *Llegó vestido de punta en blanco*) as a function of Group. On the vertical axis, the amount of word-by-word translations is presented (percentages). Bottom panel: amount of incongruent idioms' controls translated as Incongruent Idioms by Bilinguals and Translators. On the horizontal axis, the Group factor is reported; on the vertical axis, the Amount of erroneous translations (percentages) is reported.

Erroneous translation of control sentences as idioms

The data gathered so far appears to suggest that a plausible interpretation for the translators' RT data in response to the tone when they processed incongruent idioms might be the simultaneous co-activation of both the idiomatic meaning and the word-by-word computation of the string. This concurrent activation would produce competition, reducing the cognitive resources available to perform the secondary task (slower RT in tone detection).

If this reasoning is correct and translators are experiencing competition between the superlemma's and single lemmas' activation before selecting the superlemma, they might show a larger tendency to erroneously translate incongruent idioms' controls as idioms relative to the bilingual group. As an example, consider the incongruent idiom's control *Birds of a species fly together* (corresponding to the idiom *Birds of a feather flock together*) translated through the idiom *Tal para cual* or *Dios los cría y ellos se juntan,* instead of being translated literally so as to maintain its original meaning *Los pájaros de una misma especie vuelan juntos*. In order to corroborate this hypothesis, we computed the amount of incongruent idioms' control sentences erroneously translated as idioms. Afterwards, this material was analyzed through independent one-way ANOVAs with Group as factor. As for the amount of controls translated as incongruent idioms, there was a significant main effect of Group, $F(1, 27) = 6.02$, $p = .02$, $\eta^2 = .18$. The translators experienced significantly more controls to idioms translations (M = 19%, SD = 8%) compared to the bilinguals (M = 11%, SD = 9%); in other words, they tended to produce idioms instead of producing the literal translation equivalents of control sentences (see Figure 5).

The results obtained so far seem to suggest that the translators might be activating the figurative meaning of sentences even when they are processing control units. In other words, translators seem to access the idiomatic meaning of sentences even when they should not and, by consequence of this fact, they showed a general slowing down of the RTs in response to the secondary task. Hence, we might interpret the relatively slower RTs previously observed in the processing of incongruent idioms (tone detection RTs) as due to the concurrent co-activation of both the word-by-word meaning and the idiomatic meaning of the sentence. The translators might be increasing the time needed to detect the tone because they might need more cognitive resources to to control for the concurrent activation of the word-by-word and the idiomatic meaning of the sentences.

EXPERIMENT 2

In Experiment 1 we argued that the slower RT of translators in response to the secondary task might be due to the concurrent activation of the independent lexical entries and the meaning of the idiom. Experiment 2 was carried out in order to rule out the possibility that this concurrent co-activation (word-by-word and idiomatic meaning) was due to strategic factors. In Experiment 1, idiomatic sentences and their controls were presented randomly (unblocked by condition). Hence, in this situation, it might have been the case that the translators maintained the activation of both the idiomatic and the word-by-word meanings of the idiomatic strings in order to anticipate the possible presentation of an idiomatic sentence and readily react to it.

Therefore, Experiment 2 aimed at evaluating whether the mixed presentation of the idiomatic and control stimuli influenced the translators' performance in Experiment 1. To this end, in the current experiment a new group of translators received the idiomatic sentences and their controls blocked by condition. If the pattern of results observed for the group of translators in Experiment 1 (slower RTs in incongruent idioms) was not due to the presentation mode of sentences (unblocked), the same results would be obtained in this experiment (blocked presentation of sentences).

Method

Participants

Sixteen professional Spanish/ English translators (8 women and 8 men) participated in the experiment. They had not participated in Experiment 1. They all had a minimum of three years' experience working as in-house translators. All the participants were paid for their participation. Their mean age was 27.93 (ranging from 24 to 33). Before performing the experiment, participants were asked to complete the language proficiency questionnaire used in Experiment 1 to evaluate their proficiency on reading, writing, listening, and speaking in Spanish (L1) and English (L2) (Macizo & Bajo, 2006; Macizo, Bajo & Martín, 2010) (see Table 1). Analyses were performed on the self-evaluation scores for L1 and L2 proficiency, comparing Translators of Experiment 1 vs. Translators of Experiment 2; no significant differences were observed between the two groups (all *ps* > .05). Participant's characteristics are reported in Table 1.

Materials and Design

The materials and design were the same as in Experiment 1, except for the presentation of the experimental material. In the current experiment, 4 blocks of sentences were created. Two of these blocks consisted of 16 incongruent idioms, 16 congruent idioms, and 32 non-idiomatic filler sentences. The other two blocks consisted of 16 controls for the incongruent idioms, 16 controls for the congruent idioms and 32 non-idiomatic filler sentences. Hence, each participant received a total number of 128 sentences, divided into two blocks: the first comprised idiomatic items and the second included control sentences. The sentences within each block were randomly presented. In addition, the presentation of the 4 blocks was counterbalanced across participants in such a way that one participant never received the idiomatic sentence together with its corresponding control throughout the experiment. At the same time, we made certain that each sentence was presented an equal number of times both in its idiomatic and control form across all the participants.

Procedure

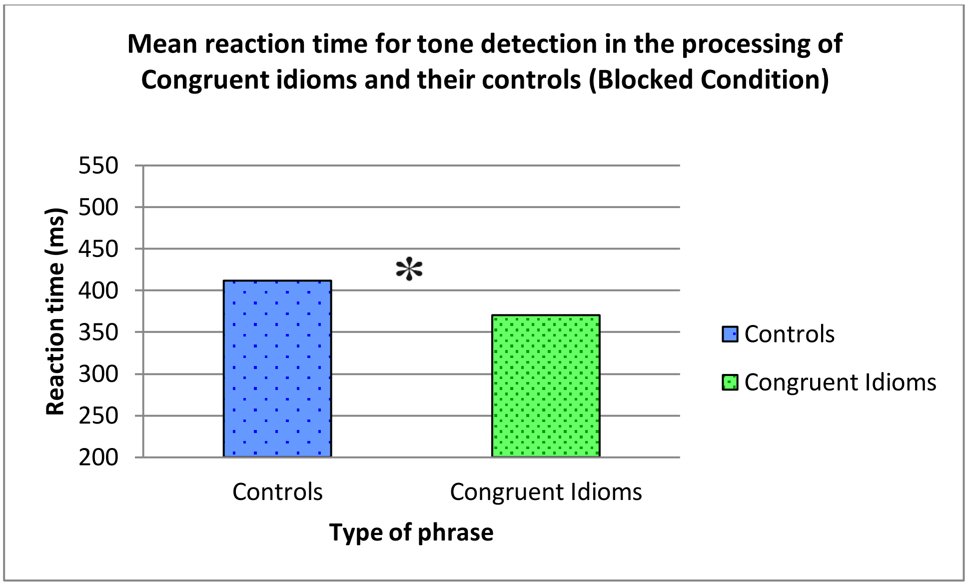
The procedure used was the same as in Experiment 1.

Results and discussion

Tone detection RTs

As in Experiment 1, these analyses focus on the RTs of correct hits in responding to the presence of the auditory tone stimulus while reading for translation. The RTs were analysed using a 2 x 2 repeated measure ANOVA; the factors were: Type of Idiom (being the levels congruent vs. incongruent) and Type of phrase (idioms vs. controls). The main effect of Type of Idiom (TI) was not significant, F_1 (1, 15) = 1.16, p = .29 .05, η_p^2 = 0.07, and $F_2 < 1$. Neither was significant the main effect of Type of phrase (TP), F_1 and $F_2 < 1$. The interaction between TI and TP was significant, F_1(1, 15) = 11.66, p = .004, η_p^2 = .43, F_2(1, 120) = 9.46, p = .002, η_p^2 = .07. The tone detection RT was faster in congruent idioms (M = 370.38, SD = 74.35) relative to their controls (M = 411.79, SD = 47.98), F_1(1, 15) = 7.07, p = .02, η^2 = .32, F_2(1, 120) = 4.60, p = .03, η^2 = .03. On the contrary, the tone detection RT was slower in incongruent idioms (M = 416.44, SD = 64.98) relative to their controls (M = 384.45, SD = 64.81), F_1(1, 15) = 8.43, p = .01, η^2 = .35, F_2(1, 120) = 4.86, p = .02, η^2 = .03. Therefore, the pattern of results obtained in Experiment 2 for the blocked condition was similar to the pattern previously observed in the group of translators (Unblocked Condition) in Experiment 1 (see Figure 6).

■ *Figure 6.* **Mean RT for correct tone detection and correct translations in Congruent, Incongruent idioms and Controls (Blocked Condition)**



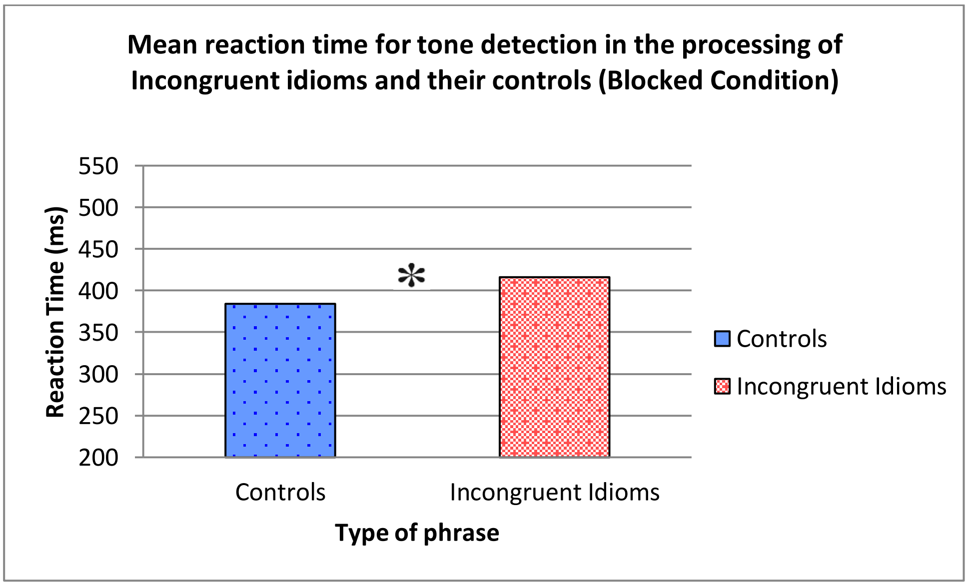


Figure 6. Results obtained in Experiment 2. Mean Reaction Times to tone detection during the processing of Congruent Idioms and their controls (upper panel) and Incongruent Idioms and their controls (bottom panel). On the horizontal axis, the Type of phrase (critical vs. control) and on the vertical axis, Reaction Times (milliseconds) are presented.

Accuracy: translation errors in correct tone detections

Accuracy analyses focused on the translation errors committed in correct tone detections. For these analyses, we considered as errors all responses that did not include the correct translation of the idiom, following the criteria adopted in Experiment 1.

A 2 x 2 repeated measure ANOVA was performed, introducing Type of idiom (congruent vs. incongruent) and Type of phrase (idioms vs. controls) as factors. The main effect of Type of idiom was significant, $F_1(1, 31) = 49.34$, $p < .001$, $\eta_p^2 = .76$, $F_2(1, 248) = 33.30$, $p < .001$, $\eta_p^2 = .12$. The interaction between TI x TP was significant, $F_1(1, 15) = 125$, $p < .001$, $\eta_p^2 = .89$, $F_2(1, 124) = 22.12$, $p < .001$, $\eta_p^2 = .15$. Less errors were committed in congruent idioms (M = 18%, SD = 12) relative to their controls, (M = 39%, SD = 20), $F_1(1, 15) = 25.37$, $p < .001$, $\eta^2 = .62$, $F_2(1, 124) = 8.27$, $p = .004$, $\eta^2 = .06$. On the contrary, more errors were observed for incongruent idioms (M = 58%, SD = 14) relative to their controls (M = 32%, SD = 14), $F_1(1, 15) = 33$, $p < .001$, $\eta^2 = .68$, $F_2(1, 124) = 14.25$, $p < .001$, $\eta^2 = .10$. Therefore, also for the accuracy in translation, the pattern of results obtained in Experiment 2 for the blocked condition was similar to the pattern previously observed in the group of translators (Unblocked Condition) in Experiment 1 (see Figure 7).

■ *Figure 7.* Mean percentage of translation errors

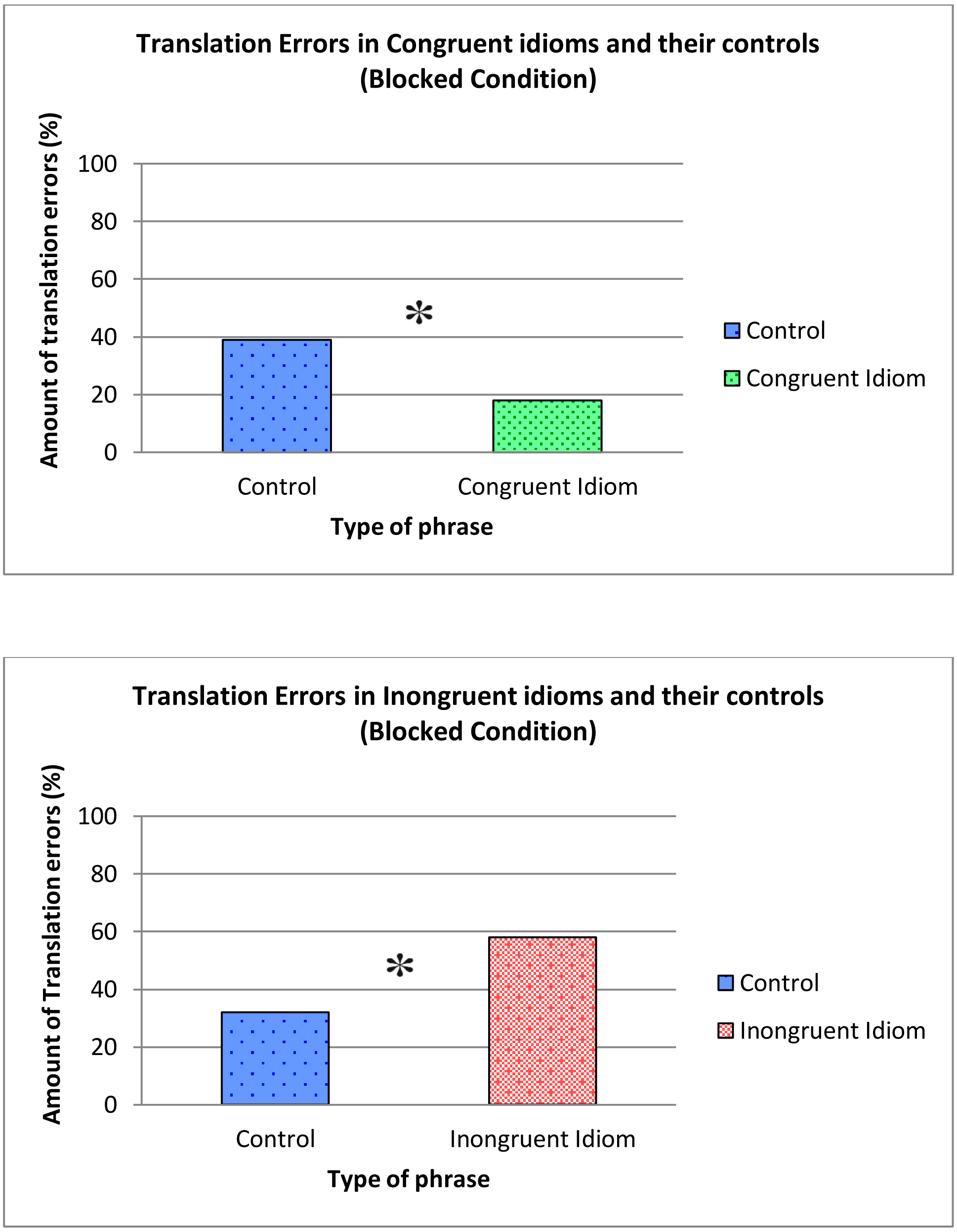


Figure 7. Results obtained in Experiment 2. Amount of Translation errors committed for Congruent Idioms and their controls (upper panel) and Incongruent Idioms and their controls (bottom panel). On the horizontal axis, the Type of phrase (critical vs. control) and on the vertical axis, Amount of translation errors (percentages) are presented.

General Discussion

The role of expertise in translation has been explored in relation to many linguistic and cognitive processes involved in translation and interpreting tasks (Christoffels, de Groot, & Kroll, 2006; de Groot & Christoffels, 2006; Ibáñez, Macizo, & Bajo, 2010; Macizo & Bajo, 2006). The present paper addressed the question of how different experiences in bilingualism might modulate the cross-linguistic processing and production of idiomatic expressions. The main idea was that different experiences in bilingualism (untrained vs. trained bilinguals in professional translation, both highly proficient) would affect differently the way in which idioms with varying similarity across languages (congruent vs. incongruent) were comprehended and translated. We explored the hybrid view of idiomatic processing (e.g., Sprenger et al., 2006; Titone & Connine, 1999) focusing on the idea that resource allocation is carried out more automatically and efficiently with professional experience in translation (Gile, 1999, 2001). Translators acquire important skills for controlling their attentional resources, so they can be considered as experts in the balance between automaticity and executive control. In the context of the current study, this would imply that translators would map L1 and L2 idiomatic expressions in a relatively more automatic and efficient way than untrained bilinguals. In order to measure the directness and ease in accessing the cross-linguistic mapping between SL and TL idioms, a concurrent dual task was employed to load cognitive resources. Participants had to detect a tone while reading visually presented sentences in the L2 with the instruction to understand and then translate them to the L1.

In the current study we observed an idiom superiority effect since the latencies for the tone detection task were faster when the tone was presented in idiomatic expressions relative to their control sentences. This facilitation has been corroborated at all stages of bilingual experience (e.g., Wolter & Gyllstad, 2011; Wolter & Gyllstad, 2013; Yamashita & Yiang, 2010) and is in line with the Hybrid models in the monolingual domain (Sprenger et al., 2006; Titone & Connine, 1999) and those studies focused on cross-linguistic idiomatic congruency per se, that show an advantage in the processing of idioms that are congruent between languages (Irujo, 1986; Walter & Gyllstad, 2011, 2013; Yamashita & Jiang, 2010;). According to hybrid models, different components of an idiom are bound together by one common entry in the mental lexicon (the superlemma, Sprenger et al., 2006) and activated twice. Thus, the activation of each idiom's element will produce a spreading activation flow towards all the remaining elements via the superlemma, resulting in faster availability of the idiomatic sequence. However, for non-idiomatic expressions (matched control expressions) no such common representation exists (Sprenger et al., 2006); therefore, a greater amount of cognitive resources might be needed in this case. In our study, this idiom superiority effect was found for bilinguals and translators when they processed congruent idioms in English (L2) to be translated into Spanish (L1). Within the hybrid models of idiomatic processing, the effect would be explained as follows: In the case of congruent English/Spanish idioms such as *You broke my heart* (whose word-by-word translation *Me rompiste el corazón* is felicitous), the activation of the figurative meaning "to hurt someone" required the selection of the superlemma *You broke my heart* over the activation of the simple lemmas "break = damage" and "heart = body part"; however, in this case, the congruency between the concepts pointed to by the individual lemmas and the superlemma exerted a facilitative effect. Additionally, this congruency was strengthened between languages, since the English and the Spanish idioms (*To break someone's heart* and *Romperle el corazón a alguien*) not only shared the concept pointed to by the superlemma ("to hurt someone"), but also the individual concepts pointed to by the single lemmas comprised in the idiom, which is "break = romper" and "heart = corazón". By consequence of this fact, higher availability of cognitive resources was observed for congruent idioms with faster reaction times in the tone detection task for both untrained bilinguals and bilinguals with professional experience in translation.

However, differences between bilinguals and translators were found when they processed incongruent idioms. Compared to bilinguals, translators showed significantly slower latencies in response to the secondary task while processing incongruent idioms for translation. These results seem to indicate that the translators would involve fewer cognitive resources to perform the secondary task while processing incongruent idioms. Alternative explanations cannot account for this slower reaction time in detecting the tone for the group of translators. Firstly, it could be argued that translators had an inferior translation competence relative to the bilingual group. However, this account does not hold since the analysis of both the accuracy in performing the translation task and the number of semantic translations confirmed that the translators outperformed the bilinguals and did have access to the superlemma as a whole, both to its linguistic (accuracy analysis) and conceptual entity (semantic translation analysis). Secondly, it might be proposed that translators showed a prevalence of word-by-word translation (i.e., the use of co-activated individual words in L1 and L2), which was incorrect to translate incongruent idioms, relative to the correct dominance of the superlemma equivalents across languages. Nevertheless, this explanation is not possible since the amount of incongruent idioms erroneously translated literally (word-by-word translation) was reduced in translators compared to bilinguals. Thus, translators did enjoy a more direct access to the translation equivalent at the superlemma level for these idioms, and seemed to adopt a more chunked approach to translation relative to the word-by-word approach preferred by the bilinguals. Thirdly, it might be suggested that translators were more sensitive to strategic factors than bilinguals. Since idiomatic expressions were randomly intermixed with literal control sentences in Experiment 1, translators might decide to maintain the activation of both the idiomatic and the word-by-word meaning of the idiomatic string during the course of the complete translation task in order to anticipate the possible presentation of an idiomatic sentence and readily react to it. Nevertheless, the pattern of results shown by translators was observed again in Experiment 2, when the sentences were blocked by condition (idioms and control sentences). Thus, this pattern of results seems to be not due to either the mode of presentation of sentences or the possible use of strategic factors by translators to perform the task.

In our view, the slower latencies in the secondary task for incongruent idioms shown by translators can be accommodated within the hybrid view of idiomatic processing. To illustrate, in the case of incongruent English/Spanish idioms such as *Kick the bucket* (whose word-by-word translation *Patear el cubo* is not felicitous), the activation of the figurative meaning "to die" required, in comprehension, the selection of the superlemma *Kick the bucket* over the activation of the simple lemmas "Kick = punt" and "bucket = pail" (Sprenger et al., 2006); in this case, the incongruence between the concepts pointed to by the individual lemmas and the superlemma resulted in competition. The results found in our study seem to support this competition account. When the tendency to erroneously translate control sentences as idioms was analyzed for incongruent material, we observed that translators experienced more controls to idiom translation than untrained bilinguals.

Thus, a plausible interpretation for the translators' RT data in response to the tone when they processed incongruent idioms seems to be the simultaneous co-activation of both the idiomatic meaning and the word-by-word computation of the string. This concurrent activation produced competition, reducing the cognitive resources available to perform the secondary task. However, a key question remains unsolved after assuming this competition account, that is, why this simultaneous co-activation and the subsequent interference for incongruent idioms was only present in translators and not in the bilingual group.

When professional translators perform translation tasks, they have to comprehend and reformulate a given message expressed in one language into another language. The main characteristic of the translation performance is that the translators not only have to understand and reformulate a message from one language into another, but they also have to keep their two languages constantly active in order to switch between them. Therefore, translators have to manage the activation of two languages and continuously cope with the interference caused by the parallel activation of their languages in translation tasks. Although inhibitory control has been suggested as the way bilinguals select the required language (e.g., Green, 1997) , this mechanism does not seem appropriate to perform translation tasks, since in these tasks both languages have to be kept active, in order to comprehend the input and produce the output respectively, almost simultaneously. Although little research has been conducted on expertise in translation as a modulating factor of the way bilinguals regulate language activation, the results obtained by Ibáñez et al. (2010) suggest that bilinguals and translators may differ as to the way they negotiate their two (or more) languages. While bilinguals without training in translation seem to use inhibition to select the language they need to use, translators seem to maintain their two languages active in an efficient manner without inhibiting any of them.

Overall, the differences we observed in idiomatic processing due to expertise in translation can be accounted for taking into consideration the intrinsic properties of the professional translation task, which is, the need for maintaining active all the possible (and competing) translation solutions up to the very moment in which the uttering of the TL output can be legibly disambiguated by the linguistic context. This process results in a less automatized behavior and higher levels of cognitive control exerted over the task, in such a way that a general slowdown is displayed in order to control the overall process (cross-linguistic co-activation and subsequent control of irrelevant information) and guarantee the high quality standards required by professional translation.

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CHAPTER VI

IDIOMATIC PROCESSING IN EARLY AND LATE BILINGUALS

In this chapter, we wanted to explore the predictions made by hybrid models on bilingual idiomatic processing regarding a possible differential access to the idioms as a whole depending on AoA. Since we wanted to explore both the L1 idiom comprehension phase and the L1 to L2 mapping between the figurative meanings, early bilingual speakers and late bilinguals were compared on the same comprehension-for-translation task previously used in Chapter V; the basic idea was that different bilingual experiences due to different Age of Acquistion (AoA) would affect differentially the automaticity with which the two groups comprehend and retrieve translation equivalents of figurative language with varying similarity across languages (congruent vs. incongruent idioms). Our hypothesis was that early bilinguals would be able to map L1 and L2 idiomatic expressions (at the superlemma level) in a relatively more automatic and efficient way compared to late bilinguals.

Behavioral ecologies of bilingualism

Psycholinguistic research has increasingly made clear that in order to develop a comprehensive understanding of the cognitive mechanisms underlying bilingual language processing, the behavioral ecology of bilingual speakers needs to be taken into account (Green, 2011). Behavioral ecology of bilingualism refers to the differences in the context and the experiences that the bilinguals have in the use of their two languages (Green, 2011). In line with this idea, the present paper explores the link between the processing of idiomatic language and the underlying cognitive functioning of bilinguals belonging to different behavioral ecologies (early vs. late bilinguals).

It has been widely recognized that the most reliable and robust predictor of second language performance is Age of Acquisition (AoA) (see Birdsong, 2006, for an overview). Second language AoA influences phonological processing (Frenck-Mestre, Anton, Roth, Vaid, & Viallet, 2005), grammaticality judgment (Hernandez, Hofmann, & Kotz, 2007; Waldron & Hernandez, 2013; Wartenburger et al., 2003), lexical access (Mahendra, Plante, Magloire, Milman, & Trouard, 2003; Perani et al., 2003) and syntactic processing (Mahendra et al., 2003). Similarly, differences in the age at which the L2 is acquired seem to influence the processes by which the two languages of the bilingual are controlled. Previous research has shown that managing two languages is linked to the enhancement of general cognitive control mechanisms that are not language-specific (Bialystok, Craik, Green, & Gollan, 2009, for a review; Green & Abutalebi 2013). In fact, bilinguals need to manage the language that is appropriate in a specific context controlling the interference caused by the inappropriate language. This language control processes have been suggested to lead to the enhancement of attentional mechanisms (Tao, Marzecová, Taft, Asanowicz, & Wodniecka, 2011). In other words, bilinguals constantly recruit the executive control system in order to manage the simultaneous activation of their two languages (Abutalebi & Green, 2007; Green, 1997; Kroll, Bobb, & Hoshino, 2014; Kroll, Van Hell, Tokowicz, & Green, 2010; van Heuven &

Dijkstra, 2010; van Heuven, Schriefers, Dijkstra, & Hagoort, 2008); through repeated practice, such processes might result in a generalization of a processing advantage to other domains of cognitive functioning (Bialystok et al., 2009; Festman, Rodriguez-Fornells, & Münte, 2010; Ye & Zhou, 2009).

Most research showing a cognitive advantage in bilinguals examined participants who learnt their two languages early in life (Tao et al., 2011); however, recently, it has also been suggested that different experiences in bilingualism (and AoA) might also produce differences in the use of executive functions (Luk, De Sa, & Bialystok, 2011). In fact, there are many ways to be bilingual: "some people are born bilingual, while some others aspire to bilingualism" (Bialystok et al., 2009: 90).

Tao et al. (2011), for example, tested early and late bilinguals employing the Lateralized Attention Network Test (LANT), which provides an index for the efficiency of the alerting networks. They reasoned that if practice in monitoring and switching between languages from an early age is fundamental for the attentional enhancement to show up, then the bilingual advantage might not be observed in late bilinguals. The authors found that AoA was critical for the monitoring advantage to be detected, since the RT advantage associated to bilingualism only emerged in the group of early bilinguals. In other words, it seems that AoA plays a fundamental role in the enhancing of monitoring processes.

Luk et al. (2011) compared monolinguals, early and late bilinguals on the Flanker task, which is, an executive control task. Namely, the authors calculated the efficiency of the three groups in executive control, and took into account three specific RT costs: 1) the difference between control/ congruent trials, indicating monitoring ability; 2) the difference between control/ incongruent trials (conflict resolution) and, finally, 3) the difference between congruent / control trials, indicating inhibition. The authors found that AoA correlated with the Flanker effect; the effect was smaller in the case of early bilinguals, being the early group more efficient in suppressing conflicting information and stronger in the maintenance of cognitive control over the task. The novelty of this study lied in the demonstration that late bilinguals (who had been using their L2 for only half of their lives) performed more like monolinguals on the executive control task.

On the basis of the evidence currently available, AoA seems to be an important factor influencing both bilingual neural organization and language behavior. In the current study, we compared bilinguals who started to use actively their L2 early or late in life in the context of idiomatic language processing.

Idiomatic language and bilingualism

Idiomatic expressions (e.g., hit the road) are multiword conventional expressions whose semantic meaning cannot be derived from the comprehension of the individual words comprised in the sentence (Cacciari & Tabossi, 1988). The evidence available on cross-linguistic idiomatic processing (i.e. Irujo, 1986, 1993) confirms that bilinguals use the information from their L1 idiomatic knowledge to attain the interpretation and translation of idioms in their L2. Thus, between language co-activation is triggered when bilinguals process idiomatic expression and therefore, cognitive control mechanisms would be required to manage the activation of the bilinguals' languages in this situation. The demands for cognitive control while processing idiomatic expressions seem to depend on the cross-linguistic correspondence between the lexical items comprised in an idiom (*the congruency effect*). Previous research has shown that idiomatic congruency is particularly relevant for the degree of influence exerted by the L1 idiom over the corresponding L2 idiom and the functioning of the cognitive control mechanisms that handle the L1/L2 co-activation (e.g., Wolter & Gyllstad, 2011; Yamashita & Jiang, 2010).

The congruency effect

Idioms can be classified as congruent or incongruent based on the degree of between-language overlapping of lexical items. Congruent idioms share identical lexical elements between two languages (Yamashita & Jiang, 2010); consider the English idiom *To break someone's heart* and its overlapping translation equivalent in Spanish, *Romperle el corazón a alguien*. In this case, word-by-word translation between languages is felicitous. On the other hand, incongruent idioms involve different lexical items cross-linguistically (Yamashita & Jiang, 2010); consider, for example, the English idiom *To kick the bucket* and its Spanish translation, *Estirar la pata*. In this case, a word-by-word approach to translate the idiom would not be felicitous. This cross linguistic feature of idioms have consequences for language processing and for the functioning of the underlying executive control mechanisms, since it makes the cross-linguistic processing of idioms particularly susceptible to transfer or interference (Irujo 1986, 1993; Wolter, 2006; Yamashita & Jiang, 2010).

There is evidence showing advantage in the processing of congruent idioms over incongruent idioms when proficient bilinguals comprehend and produce idioms in their second language. In production, Irujo (1986) employed a translation task and found that English idioms that were comprehended and produced most correctly by Spanish learners of English were congruent between languages. In her study, forty-five paragraphs in Spanish were employed, each containing an idiom that had an identical English equivalent or that was similar in form or totally different. Results from the translation task showed that congruent idioms were easier to translate compared to incongruent idioms, providing evidence that proficient speakers of a second language use their first language to produce idioms, and that the degree of similarity to first language idioms might be the most important factor influencing transfer during the translation process. It was also observed that when idioms were not produced, the most common substitute was a literal synonym or paraphrase.

The influence of idiom congruency has also been shown in comprehension (Wolter & Gyllstad, 2013); Yamashita & Jiang, 2010). For example, Walter and Gyllstad compared native speakers and proficient bilinguals on acceptability judgment tasks in English. Their finding was similar; congruency did not have an effect on native speakers' performance; however, bilinguals uniformly judged congruent idiomatic expressions as acceptable more quickly than incongruent expression. Similarly, Wolter and Gyllstad (2011) presented a verb prime to English native speakers and Swedish/ English bilinguals and observed whether it was more likely to facilitate recognition of a noun target if the resulting verb + noun idiomatic form was congruent (i.e., *to join club*) versus incongruent (i.e., *to throw party*) between the two languages considered. Significantly faster reaction times were observed for target words that were primed with words that formed congruent idiomatic expressions in Swedish (i.e., *to join club*), suggesting that the L1 exerts a considerable facilitating influence over the recognition of L2 idiomatic forms, even at high proficiency levels. Wolter and Gyllstad (2011) argued that one plausible explanation for the accelerated recognition of congruent forms was due to the parallel activation of the same patterns (translation equivalents) cross-linguistically. The authors reasoned that the English prime word stimulates its L1 translation equivalent. Upon receiving this stimulation, the L1 translation equivalent would presumably stimulate the L1 idiomatic network in concert with the L2 word stimulating its L2 idiomatic network. The general facilitation effect observed when bilinguals process congruent idioms whose figurative meaning and word-by-word translation is congruent clearly suggests that the processing demands of idiomatic expression depends on the cross linguistic congruency of idioms and that, therefore, this might be an important variable to study when investigating language control in bilinguals.

The exposure effect

The effect of idiomatic congruency explained before may depend on the degree of experience and exposure of the bilingual to the idiomatic expressions. Green and Abutalebi (2013) have suggested that dual language processing increases the cognitive demands imposed on control processes, such as interference control (conflict monitoring and interference suppression). Hence, it is possible that the demands imposed by bilingual idiomatic processing might vary as a consequence of the type of bilingualism experienced by individuals and the degree of exposure to idioms (*The exposure effect*). For example, in an eye-tracking study, Siyanova-Chanturia, Conklin, and van Heuven (2011) compared the processing of idiomatic sequences embedded in sentences with different phrasal frequency (for example, *bride & groom* vs. *groom & bride*). The authors compared native, low and high proficient bilinguals. More proficient bilinguals and native speakers read more frequent idiomatic binomials significantly faster than the reversed forms. On the other hand, less proficient non-native speakers showed no differences in reading speeds for the two phrase types. These results suggest that different types of exposure (low vs. increased exposure) to the linguistic input modulate the processing advantage observed for idiomatic processing; namely, through increased exposure, learners represent in memory not only the lexical items comprised in the idiom, but the idiom as a whole (Siyanova-Chanturia et al., 2011; Yeganehjoo & Yap, 2009); this holistic representation (defined as the *Superlemma* by Sprenger et al. 2006) fluctuates as a consequence of different types of exposure to the bilingual experience.

Similarly, Yamashita and Jiang (2010) employed a phrase-acceptability judgment task to compare native speakers of English and bilinguals (Japanese/ English) on English congruent and incongruent idiomatic expressions. In order to observe the L2 developmental change, they manipulated the degree of exposure to the L2 (high vs. low exposure). The authors hypothesized that due to increasing exposure, L2 idiomatic expressions (both congruent and incongruent) become multiword units stored as chunks in the L2 lexicon that are directly connected to the conceptual store and, as a consequence, no longer dependent on the L1 lexicon. As a result, advanced learners would show little or no difference in the processing of congruent vs. incongruent idioms relative to the low exposure group. It was observed that the low exposure bilingual group took longer and made more errors when they responded to incongruent idiomatic expressions; even though the high exposure group also made more errors on incongruent idioms, they showed no difference in reaction time between congruent and incongruent expressions. In other words, higher exposure to the L2 promotes direct links between L2 lexical items (words and idioms) and semantic or conceptual representations, as envisioned in previous theoretical frameworks (i.e., T*he Revised Hierarchical Model*, by Kroll & Stewart, 1994); however, it seems that the development of new semantic representations is a much slower process. In summary, these studies suggest that increased sensitivity to idiomatic forms in the L2 seems to be a direct consequence of increased exposure to the L2 natural environment. From this view, L2 AoA might be an important variable when exploring differences in language control during idiomatic processing.

Idiomatic congruency, Hybrid Models and the Revised Hierarchical Model in bilingual idiomatic processing

There are two main theoretical frameworks that allow accommodating the evidence available for both the exposure effect and the congruency effect in bilingual idiomatic processing: the Hybrid Approach to idiomaticity, known as the *Superlemma Model* (e.g., Sprenger et al., 2006; Titone & Connine, 1999; for a revision see Cieślicka, 2008 and Chapter V of the present work) and the *Revised Hierarchical Model* (for a revision, see Kroll et al, 2010). The hybrid models of idiomatic processing defend that retrieval of idiomatic figurative meanings runs in parallel with the literal processing of words contained in the idiom.

Therefore, when an idiom is encountered, activation spreads through both the individual lexical entries (lemmas) comprised in the idiom and a unitary lexico-semantic representation of the idiomatic string (e.g., the superlemma; Sprenger et al., 2006). The Revised Hierarchical Model (RHM; Kroll & Stewart, 1994) assumes that lexical representation in the L1 are directly and more strongly connected to their conceptual representation than the L2 lexical representation, with the latter accessing the conceptual level indirectly through L1 lexical connections. However, the continue exposure to the L2 would increase the connections between L2 lexical representations and the semantic system.

According to Yamashita and Jiang (2010), the learning of L2 idioms involves three processing stages. First, the bilingual recognizes the idiom in the L2; this recognition phase allows the initial comprehension of the meaning of the new L2 idiom. This phase is driven by the activation of the individual lemmas comprised in the idiom. Second, the idiom requires integration in long term memory, as a result of repeated exposure. In line with the predictions of the Hybrid Models and the RHM, during these two beginning phases of exposure to the L2, the idiom might be linked primarily to its individual lemmas' translations in the L1 (through linguistic lexical connections). This would imply that a one-to-one between-language correspondence is initially established between the individual lemmas comprised in the idioms. During the third phase, a direct connection is established between the L2 idiom and the concept (Yamashita & Jiang, 2010). As assumed by the RHM, the lexical links between the L2 and the L1 do not disappear, but the strength of the direct connection between the L2 and the conceptual store increases. Following Sprenger's reasoning, this would happen at the superlemma level. The superlemma is defined as the holistic and unitary representation of the idiom at the syntactic level, which includes the syntactic ordering properties of the individual lemmas comprised in the idiom. It is connected both to the idiom's unitary lexical concept as well as to the simple lemmas; as exposure increases, a direct connection between the new L2 idiomatic superlemma and the concept is built. That is, because of massive exposure, the idiom is recognized as such more automatically and autonomously, because the superlemma's activation rises above the activation threshold of the individual lemmas comprised in the idiom, without requiring L1 lexical mediation.

There is evidence supporting the predictions of the Hybrid and Revised Hierarchical Models in bilingual idiomatic processing. As mentioned above, Yamashita and Jiang (2010) observed that bilinguals characterized by high exposure to the L2 showed no differences in reaction time between the processing of congruent and incongruent idiomatic expressions, while the low exposure group showed facilitation for congruent idioms. This pattern of results indicated that even high exposure bilinguals might be dependent on the lexically-driven L1 mediation process for incongruent idioms, which results in the processing advantage showed for congruent expressions (as would be predicted by the Revised Hierarchical Model and Hybrid Models of idiomatic processing); however, massive exposure to the L2 promotes more direct links between the L2 superlemmas and concepts, in a way that should allow L2 idioms to be processed independently from the L1 lexicon (conceptually-driven processing).

The findings on bilingual idiomatic processing discussed so far provide evidence of the influence of the L1 over L2 processing, an issue that has been well demonstrated in the literature (Kroll & Stewart, 1994; Sunderman & Kroll, 2006; Talamas, Kroll, & Dufour, 1999). These insights provide good grounds for the assumption that idiomatic congruency between languages and exposure do influence the activation of the linguistic alternatives for expressing a message. The effectiveness of the cognitive routes available for processing, together with the way in which the general cognitive control mechanisms triggered for monitoring and retrieval of competing between-language representations evolve as a consequence of adaptation to the demands imposed by language use (i.e. Green & Abutalebi, 2013).

The purpose of the present study is to examine the linguistic behavior of different groups of bilinguals (early and late bilinguals) while processing and translating idioms with a varying level of congruency between languages, placing special emphasis on 1) possible between groups differences in the language control processes involved in the selection of congruent vs. incongruent idiomatic representations as framed by the Revised Hierarchical Model and the Superlemma Model and 2) the matching between these language control processes and general executive control mechanisms tapping non-verbal task (Flanker task).

The current study

The novelty of the present research lies in that, to our knowledge, this is the first study to investigate the potential link existing between idiomatic processing, executive control processes tapping non-verbal tasks and different bilingual experiences. Early bilingual speakers and late bilinguals were compared on a comprehension-for-translation task. The basic idea was that different bilingual experiences due to different Age of Acquistion (AoA) would affect differentially the automaticity by which the two groups comprehend and retrieve translation equivalents of figurative language with varying similarity across languages (congruent vs. incongruent idioms).

Our hypothesis was that early bilinguals would be able to map L1 and L2 idiomatic expressions (at the superlemma level) in a relatively more automatic and efficient way than late bilinguals. In order to measure the degree of automaticity while processing the to–be–translated idioms, we used a concurrent dual task, requiring participants to detect a tone (by pressing the space bar) while processing the visually presented sentences with instructions to understand and subsequently translate them. The basic idea underlying the use of the tone detection methodology is that the more cognitive resources are needed to process idiomatic expressions, the fewer resources will be left for processing the tone. As a consequence, longer latencies for correct tone detection would be obtained (Berent & Perfetti, 1993; Ladefoged & Broadbent, 1960). Following this logic, RTs to the tone will provide an index of the cognitive resources needed to process the different types of idioms (congruent and incongruent) by early and late bilinguals, and the ease with which this task is accomplished (i.e. automaticity).

Regarding the processing of idiomatic expressions, and based on the Superlemma (Sprenger et al., 2006) and the RHM (Kroll & Stewart, 1994) models, we predict an overall idiom superiority effect for congruent idioms (over matched non-idiomatic language) resulting in the allocation of fewer cognitive resources as a consequence of L1 transfer. Nevertheless, differences should be observed in the case of incongruent idioms on the base of AoA; incongruent idiomatic expressions are more difficult to establish in the L2 mental lexicon; high proficient, late bilinguals might be still dependent on the lexically-driven L1 mediation process for incongruent idioms; on the other hand, as would be predicted by the Revised Hierarchical Model and Hybrid Models of idiomatic processing, high proficient early bilinguals might display more direct links between the L2 superlemmas and concepts, in such a way that allows L2 idioms to be processed independently from the L1 lexicon (conceptually-driven processing). Moreover, in order to observe the matching between these language control processes and general executive control mechanisms tapping non-verbal task, a Flanker Task was administered to all participants. Between-group differences were expected in executive control processes comparing early and late bilinguals. Our prediction was that increased experience in being bilingual would be associated to advantages in cognitive control (as in Luk et al., 2011) and that these advantages would correlate with performance in processing incongruent idiomatic expressions.

METHOD

Participants

Sixteen Spanish/ English early bilinguals (12 women and 4 men) and eighteen Spanish/ English late bilinguals (9 women and 9 men) participated in the study. Their L1 was Spanish, and their L2 was English. All the participants were paid for their participation. The early bilinguals' mean age was 21.43 (range from 18 to 34). The late bilinguals' mean age was 23.88, ranging from 19 to 32. Before performing the experiment, participants were asked to complete a language proficiency questionnaire on reading, writing, listening, and speaking in Spanish and English (Li, Sepanski, & Zhao, 2006) and a lexical decision task in their L2. The two groups of bilinguals were equated in their language proficiency in Spanish and English (all *p*s > .05). They were also equated in lexical access to English words. The RTs to English words were analyzed through a one-way ANOVA introducing the Group as factor (Early vs. Late). No differences were observed in lexical access RT between the two groups (all *ps* > .05). Participants all were students at the Pennsylvania State University at the time of testing.

Since the main interest of the present study was to observe the influence of the L2 AoA on the processing for translation of idiomatic expressions, data were collected on the AoA for four different language skills: Listening, Writing, Reading and Speaking in English. *T*-test analyses were performed comparing early and late bilinguals on the starting age of acquisition of these skills, and significant differences were observed in all parameters (all *ps* <.05), indicating that the AoA for the basic linguistic competences in the L2 was significantly reduced for the early bilinguals, in which the mean for writing, reading, listening and speaking was (M = 4.51, SD = 1.24) compared to the late bilingual group (M = 10.56, SD = 5.23). Moreover, participants were compared on the age at which they began to use the L2 actively on a daily basis. Three indexes were taken into account: the age at which they started to use the L2 at home, at school, and in other contexts of the L2 behavioral ecology. The mean value resulting from these three indexes was considered as the mean onset age of active bilingualism (for a definition of active bilingualism, see Luk et al., 2011); *T*-test analyses were performed comparing early and late bilinguals on the onset of active bilingualism and significant differences were observed between the two groups: $t(32) = 8.17$, $p < .001$. Early bilinguals reported a longer history of L2 everyday usage in all the contexts mentioned above (home, school, other L2 environments) (*Mean onset of active bilingualism* = 3.45 years, *SD* = 1.89) compared to the late bilinguals (*M* = 13.44 years, *SD* = 4.54). Participants' characteristics are reported in Table 1.

■ **Table 1**

Participants' demographic characteristics

	Early Bilinguals	*Late Bilinguals*
Age (years)	21.43 (3.52)	23.88 (4.36)
Lexical access RTs (ms) (Lexical Decision Task in L2)	*Words:* 1097.92 (774.51)	*Words:* 1183 (693.06)
Mean AoA for L2 basic skills (years)	*Listening:* 3.8 (1.8) *Reading:* 4.8 (1.08) *Speaking:* 4 (1.6) *Writing:* 5.31 (1.6)	*Listening:* 10.16 (5.6) *Reading:* 10.16 (4.96) *Speaking:* 10.94 (5.88) *Writing:* 11 (5)
Mean AoA for active onset of bilingualism (years)	*Home:* 2.31 (2.38) *School:* 5.31 (2.79) *Other (daily),* *L2 Country:* 2.75 (2.79)	*Home:* 11.21 (5.19) *School:* 10.33 (4.83) *Other (daily),* *L2 Country:* 18.22 (6.84)
	Language Proficiency Questionnaire	
L1 Speech comprehension	6.5 (0.81)	6.66 (0.76)
L1 Writing proficiency	6.12 (0.95)	6.38 (0.91)
L1 Speech fluency	6.5 (0.63)	6.66 (0.76)
L1 Reading proficiency	6.25 (0.77)	6.5 (0.78)
L2 Speech comprehension	6.62 (0.71)	6.5 (0.51)
L2 Writing proficiency	6.62 (0.71)	6.44 (0.85)
L2 Speech fluency	6.62 (0.71)	6.44 (0.92)
L2 Reading proficiency	6.68 (0.70)	6.61 (0.60)

Note. The self–report ratings in L1 (Spanish) and L2 (English) ranged from 1 to 7 where 1 was not fluent and 7 was very fluent. Standard deviations are reported in brackets.

Design and Materials

The design used for the experiment was a mixed 2 x 2 x 2 design. The factor Group (Early vs. Late bilinguals) was manipulated between subjects. The variables Type of Phrase (TP, being the levels of this variable: idioms vs. their controls) and Type of Idiom (TI, being the levels: congruent vs. incongruent) were manipulated within–subjects.

The materials employed in the present Chapter were the same we used for the study reported in Chapter V (i.e. see Chapter V for an accurate description of design and Chapter VIII, Appendix A and C for Language History Questionnaire and stimulus materials, respectively).

The Flanker Task

Participants were asked to indicate the direction of a red chevron flanked by black distractor chevrons. Responses were provided using a SRBox device (E-prime tool) by pressing either the left or the right button located on each side of the box. Sample stimuli are presented in Figure 1. In control trials, the red chevron pointing left or right was presented in the center of the screen. Control trials were employed to assess baseline response times (RTs).

In congruent trials, five chevrons pointing towards the same direction were presented; the target was presented in red ink. In incongruent trials, the target chevron (also in red ink) pointed towards the opposite direction relative to distracter chevrons. Targets always appeared in any of the three central positions of the array.

Each block began with 12 practice trials. All participants were given the option of receiving more practice. After 500 ms fixation point, the stimulus was presented during 2 seconds or until a response was provided.

As in Luk et al. (2011), the following material was presented: two control blocks containing 12 trials each and two conflict blocks each containing 24 congruent and 24 incongruent trials. Trials within each block were randomized and counterbalanced both for direction of the target arrow and type of trial. Only RTs in correct responses were included in the RT analysis. The Flanker task was performed by participants before the main experimental task.

■ *Figure 1.* **Sample stimuli used in the Flanker Task**

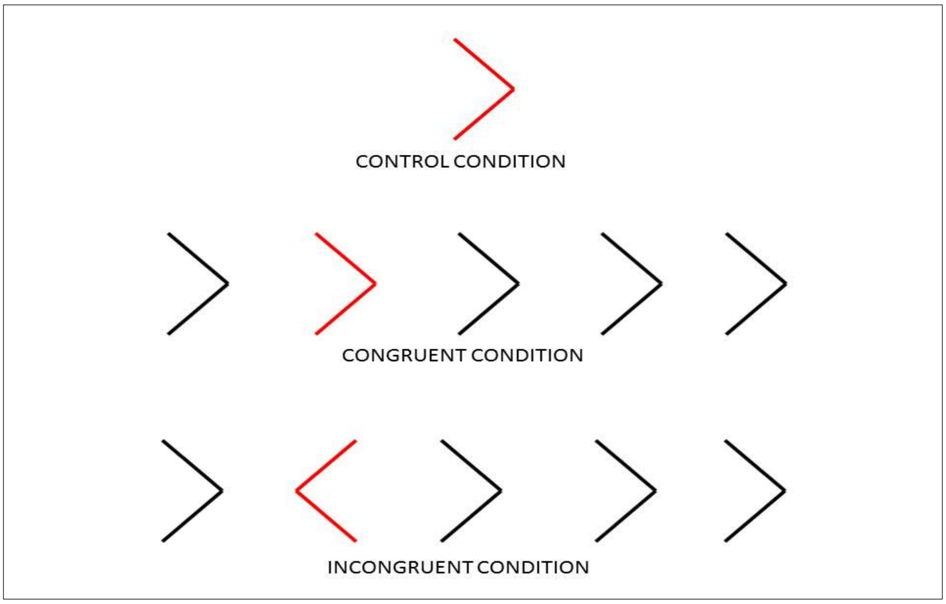

Figure 1. Sample stimuli for control, congruent and incongruent conditions used in the Flanker Task.

Procedure

The experiment was run using E-prime experimental software, 2.1 version (Schneider, Eschman, & Zuccolotto, 2002). Participants were tested individually. They were informed that they had to read sentences in English and, simultaneously, to detect a tone sound that would randomly appear on one of the words included in each sentence, by pressing the space bar with their dominant hand, right when hearing the tone. The tone stimulus duration was

250 ms. Finally, they were told that, after each sentence was displayed, they had to translate orally the whole string into Spanish. In addition, they were told that the message "Translate" would appear at the end of each sentence, indicating that they had to start the translation process.

Stimuli were presented in lower–case black letters (Courier New font, 18 point size) on a white background. Each block began with the presentation of one fixation cross displayed at the centre of the monitor for 500 ms. Before the experimental sentences, 3 practice trials with sentences that were not used in the main experiment were presented. The words comprised in each sentence were presented visually on the computer screen, word–by–word, through a rapid serial visual presentation paradigm. Each word was presented during 300 ms. Production of translations was recorded using a Digital Voice Recorder for later analyses.

RESULTS

We first report the results for tone detection RTs, followed by analyses focused on performance in translation and correlation analyses focused on the relationship between AoA and performance while processing idioms for translation.

Tone detection RTs

These analyses focus on the RTs of correct hits in responding to the presence of the auditory tone stimulus while reading for translation. The percentage of tones correctly detected was 78%. The RTs were analyzed using a 2 x 2 x 2 mixed design ANOVA with Group (early vs. late bilinguals), Type of phrase (idioms vs. their controls) and Type of idiom (congruent vs. incongruent) as factors. A main effect of Type of Phrase (TP) was observed,

$F_1(1, 32) = 5.26$, $MS = 34177$, $p = .02$, $\eta_p^2 = .14$, and $F_2(1, 229) = 6.05$, $MS = 71308$, $p = .01$, $\eta_p^2 = .02$. The main effect of Group was not significant; $F_1 < 1$, and $F_2(1, 229) = 1.53$, $MS = 18280$, $p = .21$, $\eta_p^2 = .006$. The "Type of idiom" (TI) effect did not reach significance, $F_1(1, 32) = 2.18$, $MS = 11089$, $p = .14$, $\eta_p^2 = .06$, and $F_2(1, 229) = 1.69$, MS = *20141*, p =.19 .05, $\eta_p^2 = .007$.

The two–way interaction between TP x Group was significant, $F_1(1, 32) = 7.24$, MS = 47029, $p = .01$, $\eta_p^2 = .18$, and $F_2(1, 229) = 11.77$, $MS = 139794$, $p < .001$, $\eta_p^2 = .04$; the TI x Group interaction was also significant, $F_1(1, 32) = 25.57$, $MS = 130130$, $p < .001$, $\eta_p^2 = .44$, and $F_2(1, 229) = 18.86$, $MS = 223973$, $p < .001$, $\eta_p^2 = .07$, respectively. The two-way interaction between TP x TI was not significant, $F_1(1, 32) = 3.58$, $MS = 34646$, $p = .06$, $\eta_p^2 = .10$, and $F_2(1, 229) = 2.45$, $MS = 29144$, $p =.11$, $\eta_p^2 = .01$.

The three-way interaction between TI x TP x Group was significant, $F_1(1, 32) = 5.76$, $MS = 55825$, $p = .02$, $\eta_p^2 = .15$, and $F_2(1, 229) = 5.56$, $MS = 66071$, $p = .01$, $\eta_p^2 = .02$. This interaction was further analyzed in order to evaluate possible differences due to AoA depending on the type of idiom (congruent vs. incongruent); thus, two separate mixed 2 x 2 ANOVAs were performed for each type of material.

The processing of congruent idioms. The ANOVA performed on the RTs for the processing of congruent idioms did not reveal a significant effect for Group in the analysis by subjects, $F_1(1, 32) = 1.97$, $MS = 27154$, $p = .16$, $\eta_p^2 = .05$; however, it was significant in the by-item analysis, $F_2(1, 122) = 6.71$, $MS = 61730$, $p = .01$, $\eta_p^2 = .05$. Mean value RT for congruent idioms in early bilinguals was ($M = 504.50$, $SD = 65.22$) while for late bilinguals it was ($M = 461.13$, $SD = 57.52$).

The main effect of TP was significant, $F_1(1, 32) = 12.66$, $MS = 68823$, $p = .001$, $\eta_p^2 = .28$, and $F_2(1, 122) = 11.25$, $MS = 103511$, $p = .001$, $\eta_p^2 = .08$. The interaction TP x Group was not significant, F_1 and $F_2 < 1$ (see Figure 2). Means (with standard deviations in brackets) for congruent idioms and their controls in early bilinguals were 504.50 ms (65.22) and 564.91 ms (122.37); in late bilinguals they were 461.13 ms (57.52) and 528.20 ms (125.64).

■ *Figure 2.* **Mean reaction time for correct tone detection and correct translations**

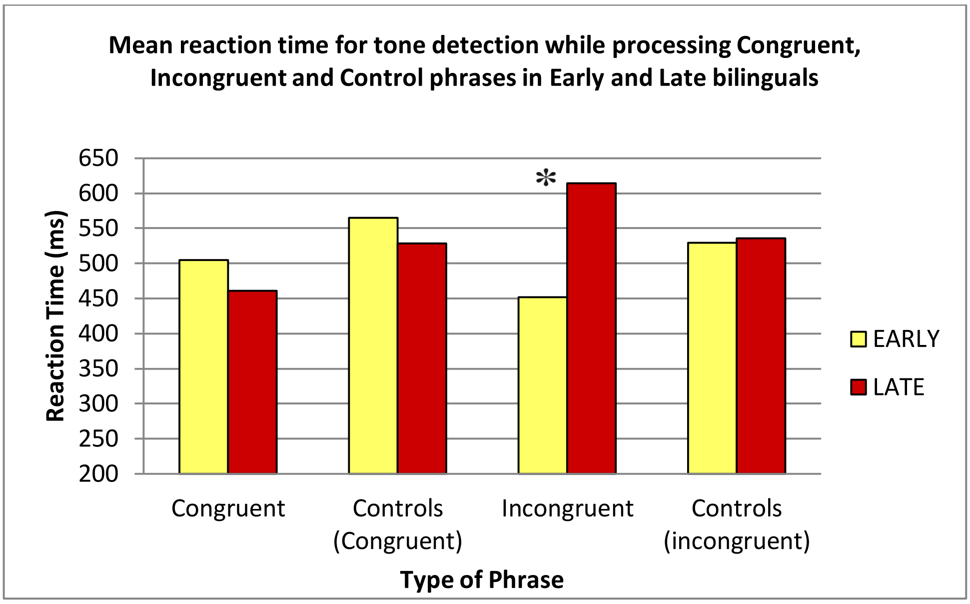

Figure 2. Mean reaction time for correct tone detection and correct translations during the processing of Congruent, Incongruent and Control sentences in Early and Late bilinguals. On the horizontal axis, Type of Phrase, on the vertical axis, Reaction Times (milliseconds) are presented.

The processing of incongruent idioms. The ANOVA for the processing of incongruent idioms showed no significant effect for TP, F_1 and $F_2 < 1$, while the Group effect was significant, $F_1(1, 32) = 5.36$, $MS = 119282$, $p = .02$, $\eta_p^2 = .141$ and $F_2(1, 107) = 11.54$, $MS = 172301$, $p < .001$, $\eta_p^2 = .09$. Mean value RT for incongruent idioms in early bilinguals was ($M = 452.01$, $SD = 64.24$) and in late bilinguals it was ($M = 613.76$, $SD = 178.70$). However, more important was the significant interaction between TP x Group, $F_1(1, 32) = 9.57$, $MS = 102666$, $p = .004$, $\eta_p^2 = .23$, and $F_2(1, 107) = 12.41$, $MS = 185262$, $p < .001$, $\eta_p^2 = .10$.

Planned comparisons were performed to compare the two groups in incongruent idioms and their controls. The difference between the two groups was not significant in the control condition, F_1 and $F_2 < 1$. Means (with standard deviations in brackets) for control sentences were 529.64 ms (92.21) in early bilinguals and 535.70 ms (137.64) in late bilinguals. Importantly, the difference between the two groups was significant in the incongruent condition, both by subjects, $F_1(1, 32) = 11.72$, $MS = 311$, $p = .001$, $\eta^2 = .26$, and by items, $F_2(1, 107) = 21.03$, $MS = 313980$, $p < .001$, $\eta^2 = .07$. The early bilingual group was faster in the secondary task while processing incongruent idioms ($M = 452.01$, $SD = 64.24$) compared to the late bilinguals ($M = 613.76$, $SD = 178.70$) (see Figure 2).

In addition, we evaluated the possible impact that the AoA for L2 basic linguistic skills (speaking, writing, listening and reading in English) might have on the allocation of the cognitive resources needed to process congruent and incongruent idiomatic strings. The correlation between "AoA for English Basic skills" and "RT to Congruent Idioms" was not significant, $r(34) = -.01$, $p = .94$. However, there was a positive correlation between "AoA of English Basic skills" and "RT to Incongruent Idioms", $r(34) = .44$, $p = .008$, suggesting that the earlier these basic abilities are acquired, the faster the response to the secondary tone detection task.

We also calculated the correlation between the age of active onset of bilingualism and RTs in performing the secondary task while processing congruent and incongruent idioms. No significant correlation was found with congruent idioms, $r(34) = -.15$, $p = .37$. Nevertheless, the correlation was highly significant in the case of incongruent idioms, $r(34) = .57$, $p < .001$. showing that the later activation of bilingualism as part of daily life is associated to slower reaction times in performing a secondary task while processing incongruent idioms for translation and, thus, to a reduced availability of free cognitive resources while retrieving translation solutions at a superlemma level for this type of idioms.

Accuracy: translation errors in correct tone detections

Accuracy analyses focused on the translation errors committed in correct tone detections. For these analyses we considered as errors the responses that did not include the correct translation of the idiom (*Kick the bucket* had to be translated as *Estiró la pata* to be considered a correct response). Thus errors included: Don't know responses, not available, refusal, nonsense translations, misinterpretation, incorrect meaning, loss, omission, word–by–word translation (idioms translated as literal speech), over–translation (literal speech translated as idioms), but also paraphrases of the idiom (see Deslie et al., 1999, for an extensive review of translation errors).

A 2 x 2 x 2 mixed designed ANOVA was performed, introducing Group (early vs. late bilinguals), Type of phrase (TP: idioms vs. their controls), and Type of idiom (TI: congruent vs. incongruent) as factors. The main effect of Group was not significant, $F_1 < 1$, and $F_2(1, 192) = 2.32$, $MS = 6.85$, $p = .12 > .05$, $\eta_p^2 = .01$. The main effect of Type of Idiom was significant, $F_1(1, 32) = 47.82$, $MS = 206.21$, $p < .001$, $\eta_p^2 = .59$, and $F_2(1, 192) = 13.47$, $MS = 39.67$, $p < .001$, $\eta_p^2 = .06$. The Type of Phrase effect was also significant, $F_1(1, 32) = 62.19$, $MS = 362.10$, $p < .001$, $\eta_p^2 = .65$, and $F_2(1, 192) = 13.47$, $MS = 38.27$, $p < .001$, $\eta_p^2 = .16$. The interaction between TI x Group was not significant, F_1 and $F_2 < 1$; the interaction TP x Group was not significant, $F_1 < 1$, and $F_2(1, 192) = 1.27$, $MS = 3.74$, $p = .26$, $\eta_p^2 = .006$. However, the interaction between TI x TP was significant, $F_1(1, 32) = 127.66$, $MS = 330.51$, $p < .001$, $\eta_p^2 = .79$, and $F_2(1, 192) = 22.81$, $MS = 67.17$, $p < .001$, $\eta_p^2 = .10$. The three–way interaction effect of TI x TP x Group was not significant, F_1 and $F_2 < 1$.

The significant TI x TP interaction was further analyzed. The difference between congruent idioms and their controls was not significant, $F_1(1, 33) = 0.12$, $MS = 0.36$, $p = .76$, $\eta^2 = .003$, and $F_2 < 1$. The amount of translation errors produced for congruent idioms in early bilinguals was (M = 24%, SD =18%); in late bilinguals it was, (M = 23%, SD = 14%). For congruent idioms' controls, the amount of translation errors was (M = 23%, SD =16%) in early bilinguals and

(M = 22%, SD = 13%) in late bilinguals (see Figure 3). Nevertheless, the difference between incongruent idioms vs. their controls did reach significance, $F_1(1, 33) = 133.22$, $MS = 698.88$, $p < .001$, $\eta^2 = .80$, and $F_2(1, 196) = 63.31$, $MS = 188.52$, $p < .001$, $\eta^2 = .24$. The errors produced for incongruent idioms in early bilinguals was (M = 57%, SD = 10%) and in late bilinguals it was (M = 61%, SD = 12%) for their controls (Figure 3). For incongruent idioms' controls, the amount of translation errors was (M = 18%, SD = 19%) in early bilinguals and (M = 19%, SD = 16%) in late bilinguals.

■ ***Figure 3.*** **Mean percentage of translation errors**

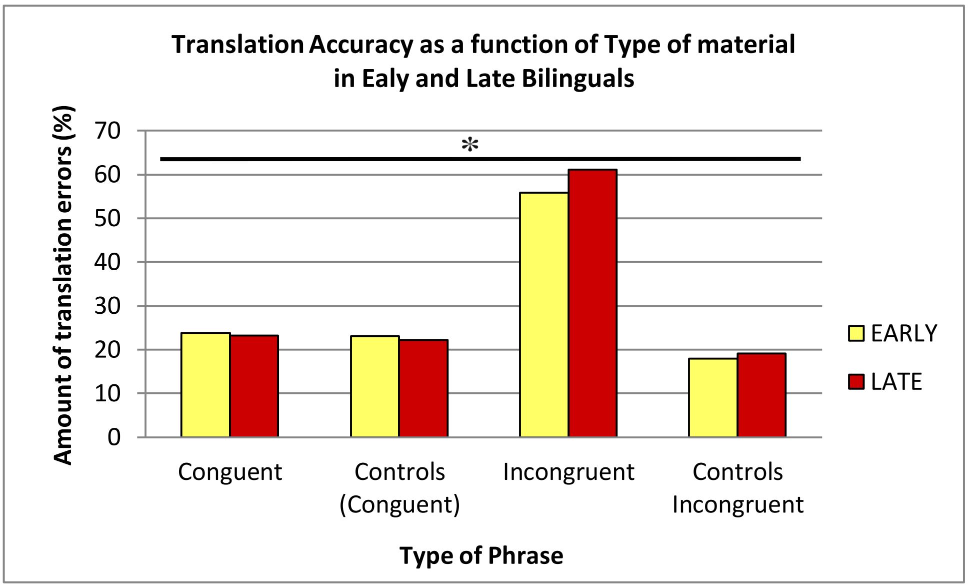

Figure 3. Mean percentage of translation errors during the processing of Congruent, Incongruent and Control sentences in Early and Late bilinguals. On the horizontal axis, Type of Phrase, on the vertical axis, Amount of Translation Errors (percentages) are presented.

Therefore, as far as accuracy in translation is concerned, no significant between-subjects differences were observed in the amount of translation errors committed. Moreover, it was observed that both groups (early and late bilinguals) produced a significantly higher amount of translation errors while translating the incongruent idioms.

The results reported so far needed to be further investigated. It has been shown that late bilinguals were slower than early bilinguals in the tone detection RTs when the tone was placed on incongruent idioms. It has also been observed that this pattern of results was not due to inferior translation ability in the group of late bilinguals, since the analysis of the accuracy in performing the translation task confirmed that the two groups did not differ in the amount of translation errors committed for the incongruent idioms. It might be possible that late bilinguals activated the literal meaning of incongruent idioms at the time they recovered their idiomatic meaning. This concurrent activation might produce interference slowing down the time needed to perform the secondary task. In order to evaluate this possibility, we evaluated the amount of incongruent idioms erroneously translated literally (word-by-word); (i.e. *He came dressed up to the nines* = *Llegó disfrazado a las nueve* instead of *Llegó vestido de punta en blanco*). When the two groups of bilinguals were considered, the late bilinguals experienced significantly more word-by-word translations (M = 50%, SD = 20%) compared to the early bilinguals (M = 37%, SD = 17%); $F_1(1, 31)$ = 4.14, MS = 36.84, p = .05, η^2 = .11, and $F_2(1, 56)$ = 5.34, MS = 18.77, p = .02, η^2 = .08.

The Flanker Task

All participants showed high accuracy rates in the Flanker task. The mean percentage of accuracy for both groups was 97%. The descriptive statistics for the RT in the Flanker task are reported in Table 2. As in Luk et al. (2011) three RT costs were calculated (see Figure 4).

■ ***Table 2.*** **Mean response times (ms) for correct trials in the three conditions of the Flanker task**

	FLANKER TASK		
GROUP	***Control***	***Congruent***	***Incongruent***
Early	378.39 (57.45)	517.80 (148.27)	593.81 (161.13)
Late	415.55 (69.21)	514.55(69.30)	569.39 (79.11)

Table 2. Mean response times and standard deviations (in brackets) for correct trials in the three conditions of the Flanker task.

■ ***Figure 4.*** **Mean Cost (response times, ms) for the Flanker Effect**

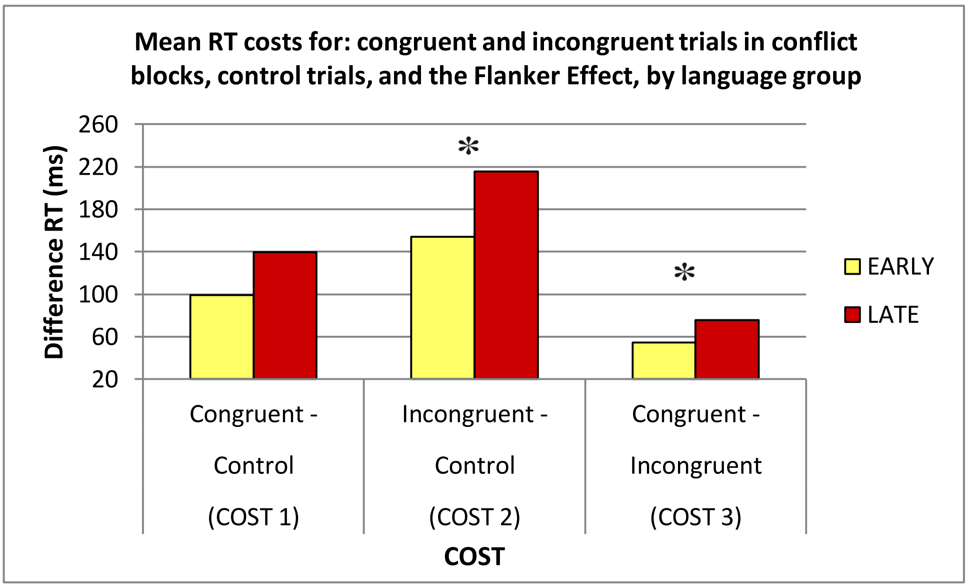

Figure 4. Mean RT costs for congruent and incongruent trials in conflict blocks relative to control trials and the Flanker Effect (Incongruent-Congruent), by language group.

The first index (cost 1) was the difference between control and congruent trials; this parameter indicates the time necessary to perform the visual search task in the case of non-conflicting flankers; the second index (cost 2) was the difference between incongruent and control trials, indicating the time required to perform the visual search in presence of conflicting distractors.. The third index (cost 3) was the difference between congruent and incongruent trials; this value indicates the time needed to solve the conflict emerging from the visual search task while switching between congruent and incongruent trials (Luk et al., 2011). This effect, analogous to other switching effects reported in the literature, has been interpreted as revealing the cost associated with switching between the bilingual's languages. This shifting in the mindset demands more cognitive resources than simple rule-holding and is known as the conflict effect (Costa et al., 2008).

In the case of the first index (control- congruent trials), the one-way ANOVA showed no differences between the two groups, $F(1, 32) = 2.46$, $MS = 13883$, $p = .12$, $\eta^2 = .07$. Mean RT (with standard deviations in parenthesis) for Cost 1 in early bilinguals was 98.99 ms (31.45), while in late bilinguals it was 139.41 ms (98.45).

As for the second (control – incongruent) and third index (congruent – incongruent) the differences between the two groups were significant, $F(1, 32) = 4.56$, $MS = 32131$, $p = .04$, $\eta^2 = .12$, and $F(1, 32) = 6.52$, $MS = 3798$, $p = .01$, $\eta^2 = .16$, with the early bilinguals showing the smallest cost relative to the late bilinguals both in the second (early: $M = 153.83$ ms, $SD = 28.89$; late: $M = 215.42$ ms, $SD = 111.88$) and the third index (early: $M = 54.83$ ms, $SD = 27.67$; late: $M = 76.01$ ms, $SD = 20.49$).

Early bilinguals suffered less interference from incongruent flakers than late bilinguals, suggesting that the mechanisms involved in conflict resolution (index 2) and inhibition (index 3) are more efficient for the former group.

Finally and most importantly, we examined the correlation between the three cost indexes for the whole sample of bilinguals (early and late) and their RTs in response to the tone detection. When we considered the processing of congruent idioms, none of the correlations between the costs in the flanker task and the RT in the secondary task were significant (all *ps* > .05; see Table 3).

■ *Table 3.* **Correlations between three costs in the Flanker Task and Type of Material**

	COST 1	*COST 2*	*COST 3*
Congruent idioms	-0.04	-0.03	-0.02
Controls (Congruent)	0.29	0.28	0.1
Incongruent idioms	*0.57	*0.60	*0.38
Controls (Incongruent)	0.18	0.22	0.25

Table 3. Correlations between the three cost indexes in the Flanker Task for the whole sample of bilinguals (early and late) and their RTs in response to the tone detection. Significant values are marked by an asterisk.

However, all costs correlated significantly with the RTs to the secondary task while processing incongruent idioms. Correlations were: $r(32) = .57$, $p < .001$ for cost 1, $r(32) = .60$, $p < .001$ for cost 2, and $r(32) = .38$, $p = .02$ for cost 3. In other words, a higher efficiency in cognitive control (smaller flanker effect) is associated to reduced RTs and, as a consequence, a higher level of availability of cognitive resources in the processing and translation of incongruent idioms.

DISCUSSION

Bilingual idiomatic processing and AoA

The present paper explored the link between the cross-linguistic processing of idiomatic language and the underlying executive control mechanisms, comparing individuals belonging to different bilingual experiences (early vs. late bilinguals). The impact of the AoA on syntactic processing had already been observed in the literature (Hernandez, Hoffman and Kotz, 2007; Saur et al., 2009; Wartenburger et al., 2003), and the present study confirms the importance of taking into consideration different types of bilingualism even in a special case of syntactic processing, which is, cross-linguistic idiomatic processing.

The main idea of the present study was that different bilingual experiences would affect differently the way in which idioms with varying similarity across languages (congruent vs. incongruent) were comprehended and translated. More specifically, we expected that there would be no differences in the processing-for-translation of *congruent idioms*; overall, we expected to observe an idiom superiority effect in both groups as to the processing of congruent idioms relative to their controls. Indeed, this idiom superiority effect for congruent idioms was observed in both groups of bilinguals, since the latencies for the tone detection task were faster when the tone was presented in congruent idiomatic expressions relative to their control sentences. This facilitation effect has been corroborated at all stages of bilingual experience (e.g., Wolter & Gyllstad, 2011; Wolter & Gyllstad, 2013; Yamashita & Jiang, 2010) and is in line with the Hybrid Models of idiomatic processing in the monolingual domain (Sprenger et al., 2006; Titone & Connine, 1999) and those studies focused on cross-linguistic idiomatic congruency per se, that show an advantage in the processing of idioms that are congruent between languages (Yamashita & Jiang, 2010; Walter & Gyllstad, 2011, 2013; Irujo, 1986). According to hybrid models, different components of an idiom are bound together by one common entry in the mental lexicon (the superlemma, Sprenger et al., 2006). The activation of each idiom's element will produce a spreading activation flow towards all the remaining elements via the superlemma, resulting in easier processing of the idiomatic sequence in the L2 (facilitation effect) because of the overlapping between the L1/L2 individual lemmas, superlemmas and concept. By consequence of this fact, higher availability of cognitive resources was observed for congruent idioms with faster reaction times in the tone detection task for both early and late bilinguals. This pattern of results was corroborated in the analysis of accuracy in translation, since no differences were observed between the two groups in the amount of translation errors produced for congruent idioms relative to their controls; both groups produced a similar amount of errors for congruent idioms and their controls (literal speech).

Importantly, no significant correlation was observed between the "AoA of English basic skills" (speaking, writing, listening and reading in English) and the allocation of the cognitive resources needed to process congruent idioms, suggesting that the early acquisition of these competences does not predict the level of automaticity in retrieving congruent idioms' superlemmas for their subsequent translation. Moreover, we did not find a significant correlation between the "AoA of active bilingualism" and the RTs in performing the secondary task while processing congruent idioms. These data suggest that earlier activation of bilingualism as part of daily life does not predict a more efficient allocation of the cognitive resources needed to process congruent idioms for translation. In other words, in the case of congruent idioms, the idiom superiority effect and the facilitation effect observed in the retrieval of translation equivalents at the superlemma level is observed at all stages of bilingual exposure.

On the other hand, we expected to observe differences due to the AoA in the allocation of the cognitive resources recruited to perform the translation of *incongruent idiomatic expressions*: we hypothesized that the processing for translation of incongruent idioms would require more exposure to the L2 linguistic environment relative to congruent idioms; namely, it was assumed that the AoA factor would have a strong impact on the allocation of the cognitive resources needed to retrieve translation equivalents of incongruent idioms; we hypothesized that the process would be carried out more automatically and efficiently in the early bilingual group.

In the RTs analysis, differences between early and late bilinguals were found when they processed incongruent idioms. Compared to early bilinguals, late bilinguals showed significantly slower latencies in response to the secondary task while processing incongruent idioms for translation. These results seem to indicate that the late bilinguals had fewer cognitive resources available to perform the secondary task while processing incongruent idioms.

Other possible explanations could not justify this slower reaction time in detecting the tone for the group of late bilinguals. Firstly, it could be argued that the late bilinguals had an inferior L2 proficiency or translation competence relative to the early bilingual group. However, participants were equated in proficiency both in the L1 and L2 and lexical access in their L2. Similarly, an account based on differences in translation competence does not hold, since the analysis of the accuracy in performing the translation task confirmed that the two groups had equal access to the incongruent idioms' superlemma.

The data presented so far suggests that a plausible interpretation for the translators' RT data in response to the tone when they processed incongruent idioms might be the simultaneous co-activation of both the idiomatic meaning and the word–by–word computation of the string. This concurrent activation would produce competition, reducing the cognitive resources available to perform the secondary task (tone detection). The significant correlation between "AoA of English Basic skills" and "RT to Incongruent Idioms" strongly argues in favor of this interpretation, since it establishes a direct link between the AoA and the automaticity reached in the retrieval of incongruent idioms as a whole. To put it differently, AoA would have a considerable impact, drawing on Sprenger's words, on the activation of the superlemma as a whole, on a threshold that exceeds the activation of the individual lemmas comprised in the idiom.

In order to assess this possibility, we evaluated the amount of incongruent idioms erroneously translated word-by-word. Interestingly, it was observed that late bilinguals showed a prevalence of word-by-word translation (i.e., the use of co-activated individual words in L1 and L2), leading to incorrect translations of incongruent idioms, relative to the correct dominance of the superlemma equivalents across languages showed by early bilinguals. Thus, early bilinguals enjoyed a more direct access to the translation equivalents at the superlemma level for these idioms, and seemed to adopt a more chunked approach to translation relative to the word-by-word approach preferred by late bilinguals.

This result, which indicates the gradual independence from the L1 lexicon and the adoption of a more chunked approach to L2 processing, is in line with the prediction of Kroll and Stewart (1994) and Sprenger et al. (2006) and the studies available on AoA and syntactic processing, that indicate that AoA is one of the most influencing factors of neural organization when syntactic processing is at play (Hernandez, Hoffman and Kotz, 2007; Saur et al., 2009; Wartenburger et al., 2003).

Bilingual idiomatic processing and cognitive control

On the other hand, we wanted to explore the link between bilingual idiomatic processing and the functioning of general cognitive control mechanisms that are not language-specific. One of the most outstanding abilities of bilingual speakers is their ability to keep their two languages separated in order to avoid interference in discourse. This is especially true in the case of idiomatic processing, since the cross-linguistic processing of incongruent idioms requires a twofold control of interference: 1) the one exerted by the stronger L1 over the L2 (Costa, Hernández, Costa-Faidella, & Sebastián-Gallés, 2009; Costa, Hernández, & Sebastián-Gallés, 2008) and 2) the one exerted by the simple lemmas over the superlemmas (Sprenger et al., 2006). When producing and comprehending idioms, bilinguals need to ensure that the correct lexical representations are accessed at the superlemma level avoiding the interference exerted by one language on the other and a word-by-word translation of the original idiom. As an example, when an English incongruent idiom (*kick the bucket*) has to be translated into Spanish (*estirar la pata*), the idiomatic meaning (*to die*) would foster the activation of the proper, idiomatic lexical entries in Spanish (*estirar, pata*) which would compete with those associated to the translation of the independent, literal lexical units of the English idiom (*kick* = *patear, bucket* = *cubo*). That is, to achieve successful communication bilinguals need to ensure that only superlemma representations of the intended language are selected and finally uttered. Then, it is possible that different levels of executive function performance for bilinguals are related to the efficiency in incongruent idiomatic processing.

Replicating previous research (i.e., Luk et al., 2011) early bilinguals showed less interference on the flanker task compared to late bilinguals. Early bilinguals showed enhanced ability to resolve the conflicting information from competing cues relative to the late bilinguals and higher maintenance of the focus of attention on the target while ignoring the distractors (reduced cost in index 2); moreover, they also showed less cost in index 3, interpreted as revealing the cost associated to the switch between the bilingual's languages and, by consequence, to the inhibition exerted over the non-needed language in order to employ only the language needed in a specific context, preventing massive interference from the non-response language. Importantly, the novel finding of the present study is the correlation between the three cost indexes for the whole sample of bilinguals (early and late) and their RTs in response to the tone detection task while processing idioms for translation.

All costs correlated significantly with the RTs to the secondary task while processing incongruent idioms, revealing that a higher efficiency in cognitive control (smaller flanker effect) is associated to reduced RTs and, as a consequence, to higher levels of availability of the cognitive resources recruited to process and translate incongruent idioms. Since incongruent idiomatic processing between languages (see the example above) implies resolving conflicting information from competing cues (lemmas and superlemmas activated cross-linguistically) higher maintenance of the focus of attention on the target (superlemma) ignoring the distracters (individual lemmas comprised in the idiom) is needed; this might be the reason why a correlation was found between index 2 (conflict resolution) and RTs in performing the dual task while processing incongruent idioms. Moreover, the correlation found between index 3 (inhibition) and RTs might be interpreted as due to the inhibition of irrelevant information (individual lemmas) to prevent interference during the processing-for-translation of incongruent idioms at the superlemma level.

These two correlations are in line with the amount of incongruent idioms erroneously translated word-by-word. In this analysis, late bilinguals showed a preference towards the word-by-word translation over the superlemma translation relative to the early bilinguals, which implies that more efficient idiomatic processing is linked to higher levels of conflict resolution (single lemmas and superlemma activation) and inhibition of non-relevant information (single lemmas activation). This observation replicates and expands previous research showing that bilingualism affects the performance of tasks that tap general attentional control mechanisms and that do not involve language use.

Interestingly, even index 1 (monitoring, where conflict resolution is not needed) correlated significantly with the RTs gathered for incongruent idiomatic processing, which could be interpreted as follows: more efficient idiomatic processing is linked to more powerful monitoring processes (for a similar interpretation see Bialystok, 2006). As reported in Costa et al. (2009), since the Flanker task includes congruent and incongruent trials, participants have to readjust constantly their behavior according to trials, in order to determine the appropriate response. This continuous monitoring process in charge of detecting potentially conflicting information, that depends also on the executive control networks (Costa et al., 2008) and correlates with the allocation of the cognitive resources needed to process incongruent idioms, confirms that efficient idiomatic processing requires higher levels of monitoring over the possible conflict emerging during the task.

CONCLUSIONS

The results reported in this study allow us to conclude that AoA in bilingualism has a major impact on the achievement of a more efficient functioning of the cognitive mechanisms underlying idiomatic processing. The impact of AoA is especially evident in the case of incongruent idioms: differences between early and late bilinguals were found when they processed this type of idioms. Compared to the early bilinguals, late bilinguals showed significantly slower latencies in response to the secondary task while processing incongruent idioms for translation, indicating that the late bilinguals could count on less available cognitive resources to perform the secondary task while processing them. It was observed that this pattern of results was due to the fact that late bilinguals activated the literal meaning of incongruent idioms at the time they recovered their idiomatic meaning. This concurrent activation produced interference slowing down the time needed to perform the secondary task. The correlations between the "AoA of English basic skills" and "AoA of active bilingualism" and the RTs in response to incongruent idioms confirmed that fluctuation in the AoA of the L2 can predict performance in idiomatic processing for posterior translation. Furthermore, the analysis of the Flanker task and the correlations observed between this task and performance in the processing of incongruent idioms suggest that the cognitive control benefit and advantage associated to early bilingualism can also predict the efficiency in the processing of idioms cross-linguistically.

Thus, we can conclude that AoA and the cognitive benefits associated to the early acquisition of the L2 exert a positive effect on bilingual idiomatic processing. Furthermore, our results suggest that these beneficial effects are predicted by three subcomponents of the executive control network: monitoring processes (index 1), conflict resolution (index 2) and inhibition of irrelevant information (index 3).

Further research should be carried out on the line of ideas proposed in the present study in order to further disentangle all the variables having an impact on the efficiency of the cognitive mechanisms recruited in bilingual idiomatic processing.

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CHAPTER VII

GENERAL DISCUSSION

GUIDING REMARKS

The research we have conducted in this doctoral thesis aimed at examining whether having to negotiate activation of two or more languages shapes the balance between automaticity and cognitive control in the mind of the bilinguals. Bilingualism is not an unitary entity (i.e. Green & Abutalebi, 2013; Luk & Bialystok, 2013), however, it has been considered as such in the past. During the past fifty years, cognitive research done in bilingualism and expertise in translation addressed possible differences in linguistic processes due to bilingualism. The research strategy consisted in comparing (a) types of individuals (monolinguals, professional translators, non-trained bilinguals, etc.,) (e.g., Bialystok & Luk, 2011), (b) types of task (within- and between-language tasks such as reading, paraphrasing, translation, etc., e.g., Ruiz, Paredes, Macizo & Bajo, 2008) (see a revision in Chapter I, Section *Availability of cognitive resources and automaticity in linguistic tasks*). Research on these linguistic processes suggests that general cognitive skills might be enhanced in bilinguals; under this assumption, many studies have explored the existence of a bilingual advantage and its transfer to non-verbal domains (see Chapter I, section *Expertise in Translation: balance between Automaticity and Cognitive Control*).

The research line we have drawn in this thesis changes this empirical trajectory by returning to the origin of scientific studies on expertise. In the problem solving field, many studies tried to identify general skills (heuristics) which would underlie the resolution of any problem (Mayer, 1983). Subsequently, it was assumed that the acquisition of expertise in a specific domain required the balance between automaticity of some aspects of the task and cognitive control over some others (Chi, 2006; Ericsson, 2006). This approach was embraced in the first part of our research by focusing on the balance between automaticity and cognitive control in individuals belonging to different linguistic behavioral ecologies. Afterwards, we considered how the regulation between automaticity and control determines language use in speakers of two or more languages. This was done by examining the way individuals negotiate the activation of their two languages to flexibly adapt to the demands imposed by linguistic tasks.

THE BALANCE BETWEEN AUTOMATICITY AND CONTROL MAINTENANCE IN NON-LINGUISTIC TASKS

The balance between automaticity and cognitive control in the non-verbal domain was explored with individuals belonging to different linguistic behavioral ecologies (Chapter III). Our interest in these comparisons stemmed from the basic assumption that both for bilinguals (Green & Abutalebi, 2013) and translators (Morales et al., 2015) it has been shown that the abilities acquired through their specific linguistic experience do transfer to other domains, such as non-verbal tasks that trigger the same cognitive processes needed for linguistic processing (Green & Abutalebi, 2013). We compared monolinguals, bilinguals and professional translators in a memory search task (Schneider & Shiffrin, 1977; Wolfe, 1994; Wolfe, Brunelli, Rubinstein, & Horowitz, 2013), in which the memory load was manipulated. Across the initial phase of the task, the memory search was carried out in a serial and controlled manner by the three groups, since the memory load affected all groups' RT in their search-in-memory, consistent with the findings by Shiffrin and Schneider (1977). After 1500 consistent practice trials, the Memory-set size effect disappeared in the monolingual group, indicating that the memory search process did automatize for this group. Nevertheless, the Memory-set Size effect was still observed in bilinguals and translators. In other words, despite the consistent practice throughout the initial 1500 trials, their memory search was still highly dependent on load, suggesting that bilinguals and professional translators kept performing their memory search in a controlled, resource consuming manner. Such a pattern of results was surprising, since at the light of those studies that report that translation ability is based on automaticity of retrieval processes (e.g., Christoffels, de Groot, & Kroll, 2006; Christoffels, de

Groot, & Waldorp, 2003; Padilla, Bajo, & Macizo, 2005) we expected translators to generalize such pattern to a more general cognitive level. Contrary to our initial predictions, translators showed sustained maintenance of cognitive control in the memory search task, despite the fact that they carried out consistent practice throughout 1500 trials (15 hours training). Moreover, the pattern observed for translators did not differ from the one observed for bilinguals, and both groups maintained high degrees of cognitive control over their search along all trials in the experiment.

At first glance it could be assumed that automaticity is always advantageous to perform a task. However, the results found in the memory search task showed that this is not always the case. Concretely, in the monolingual group, automaticity had the side effect of increasing the switching cost when a new configuration of the task was introduced (after the switch point, in which the relationship between targets and distractors was reversed). Thus, although automaticity was advantageous when considering learning consistent aspects of the skill (pre-switching trials), it implied a cost when novel stimuli were presented. However, since translators and bilinguals maintained sustained executive control over the whole task, the cost associated to the switch condition was lower compared to monolinguals. In other words, the apparently less efficient performance turned into an advantage for bilinguals and translators when the task required facing new stimuli and search in memory for previously distractor information. Hence, it seems that cognitive control maintenance was responsible for enhanced cognitive flexibility in handling novel and conflicting stimuli.

The results found in Chapter III are in line with previous research highlighting the fact that bilinguals maintain cognitive control when they perform non-linguistic tasks such as the Simon task (Bialystok, 2006; Bialystok et al., 2008), the flanker task (Costa et al., 2008), switching tasks (Prior & MacWhinney, 2010), or anti-saccade tasks (Bialystok et al., 2006a). Moreover, the maintenance of cognitive control over the memory search task had advantages in the sense that bilinguals were able to flexible face up and adapt to new rules when necessary (the switching point in the memory search task). This superior capacity to adapt to task requirements is analogous to that observed by Yudes, Macizo, and Bajo (2011). In the Wisconsin Card sorting test employed in their study, professional translators showed higher degree of cognitive flexibility when they were required to change the hypothesis linked to the categorization rule inferred. Overall, that study suggested enhanced cognitive flexibility due to professional expertise and high cognitive control maintenance. In our research, this flexibility was found in both bilinguals and translators: when a switching was introduced and the task required searches through previously distractor information, they showed better performance than monolinguals, suggesting that bilinguals confronted adaptively the changes in task goals.

THE BALANCE BETWEEN AUTOMATICITY AND CONTROL MAINTENANCE IN LINGUISTIC TASKS

Once we outlined the differences due to bilingualism in the balance between automaticity and control maintenance in non-linguistic tasks, we aimed at determining how this balance applied to the linguistic domain. The similarities between cognitive control in non-verbal task (e.g., memory search task) and other language tasks come from the assumption that individuals have to manage active representations in both cases. Thus, while the memory set had to be maintained active in the memory search task, linguistic representations have to be kept activated when individuals use their languages (e.g., a translation task). We focused on two types of linguistics contents; syntactic and semantic representations used to disambiguate relative clauses and to process idiomatic expressions, respectively.

The processing of syntactic information

In relation to syntactic knowledge, Chapter IV focused on how professionals solve syntactic ambiguity when performing either a simple reading task or the interpreting task. In ambiguous sentences like *Someone shot the servant of the actress who was on the balcony* there are two antecedents, "servant" and "actress", and both are potential correct agents of the clause "was on the balcony". Native English speakers solve the ambiguity adopting a low attachment strategy (they would identify as agent of the sentence "the actress"); Spanish speakers prefer a high attachment strategy ("the servant"). Bilingual speakers do not show any clear preference. In our experiment, it was observed that the preference towards one strategy or the other by professional interpreters was not fixed as in monolinguals; it was task-driven: when professionals had to read for repetition, despite being Spanish native speakers, they did not show any preferred attachment strategy (as observed for bilinguals in previous studies, Fernández, 1995). Importantly, interpreters selected the TL preferred strategy during the interpreting process.

According to MacMhinney (2005) syntactic cues which are shared across the languages of a bilingual are needed to parse sentences (i.e., word order, animacy, etc.). The absence of a clear attachment preference when translators read and repeated sentences confirmed that they maintained sustained control over these activated cues. Therefore, these results suggest that bilinguals exhibited an automatic co-activation of their languages at the syntactic level. The same conclusion was drawn in previous studies about co-activation of lexical units. To illustrate, in sentence comprehension, Ibáñez et al. (2010) observed a processing advantage for cognate words in the case of professional translators, indicating that both languages were maintained active during the reading process.

In addition, the differences between the reading-for-repetition and reading-for-interpreting task suggest that professionals handle the co-activation of their languages in a flexible manner. When reading for interpreting, professionals were able to adapt their response to the requirement of the task: since the receiver of the translated sentence (an English reader) would prefer low attachment, the interpreters adjusted their understanding of the sentence to the syntactic strategy preferred by the receiver of the translated message. The flexibility shown in adapting the linguistic response to the interactional context at hand mirrors the pattern of results observed in the non-verbal (memory search) task employed in Chapter III: what seems to characterize both the linguistic and the overall cognitive behaviour of professional translators is flexibility; when they are required to re-adjust their cognitive behavior to handle novel tasks (both linguistic and non-linguistic), professionals flexibly accommodate their response to the requirements imposed by the environment.

Moreover, the change in the use of syntactic strategies shown by the translators depending on the task indicates that they monitored the interactional context, and they maintained active the task goal (the efficient mapping of SL stimulus onto adequate TL responses). This efficient monitoring of linguistic representations adds to the observation that translators exhibit a more efficient use of metalinguistic and cognitive control-related abilities during comprehension. For example, when bilinguals are immersed in reading a text, they show superior ability to monitor and detect lexical and semantic errors (Yudes et al., 2011), indicating that they have efficient metalinguistic skills to revise lexical and syntactic forms.

The processing of idiomatic expressions

In the last part of the empirical work comprised in this dissertation we also explored the balance between automaticity and control of linguistic knowledge, but in this case, we considered the processing of idiomatic expressions. Concretely, we employed a translation task where we manipulated the cross-language congruency between idiomatic expressions, and compared their comprehension relative to matched non-idiomatic, control expressions.

Idioms were employed as a tool to explore the degree of automaticity in retrieval of translation equivalents, due to their functioning as lexicalized, chunked units (Tremblay & Baayen, 2010; Wray, 2005;). Moreover, we considered here varieties of bilingualism under the assumption that the experience, the training and the exposure to languages modulate the way individuals manage them and become experts in linguistic tasks (Green & Abutalebi, 2013). Thus, in Chapter V we compared untrained bilinguals vs. professional translators, while in Chapter VI early vs. late bilinguals were compared.

As far as the first comparison (Chapter V) is concerned, our hypothesis was that professional translators, compared to untrained bilinguals, would be able to map L1 and L2 idiomatic expressions (at the superlemma level; see Sprenger, Levelt, & Kempen, 2006, for a definition of superlemma) in a relatively more automatic and efficient way than untrained bilinguals, due to their extensive practice in acquiring the specific sub-skills (automaticity in lexical and semantic retrieval) involved in the translation process.

In order to measure the degree of automaticity in the processing of the to-be-translated idioms, we used a concurrent dual task in the reading-for-translation phase. First of all, RTs to the tone detection were analyzed as an index of the cognitive resources needed to process different types of idioms (congruent and incongruent) by bilinguals and professional translators, in order to explore the ease with which (i.e., automaticity) the task was accomplished.

We observed an idiom superiority effect for congruent idioms (idioms whose lemmas and superlemmas overlap cross-linguistically; for example, *You broke my heart = Me rompiste el corazón*) since the latencies for the tone detection task were faster when the tone was presented in congruent idiomatic expressions relative to their control sentences. This facilitation effect has been corroborated at all stages of bilingual experience (e.g., Wolter & Gyllstad, 2011; Wolter & Gyllstad, 2013; Yamashita & Yiang, 2010) and is in line with the Hybrid models of idiomatic processing (Sprenger et al., 2006; Titone & Connine, 1999). According to hybrid models, the individual lemmas comprised in the idiom are linked through a shared holistic entry in the mental lexicon: the superlemma, which includes the syntactic ordering properties of the idiom (Sprenger et al., 2006). Thus, the activation of each idiom's element will produce a spreading activation flow towards all the remaining elements via the superlemma, resulting in double activation (lemmas + superlemma) and faster availability of the idiomatic sequence in the L2 (facilitation effect) because of the dual language activation and the match between the lemmas and superlemmas activated cross-linguistically. The facilitation effect observed for congruent idioms is comparable to the facilitation effect observed for the processing of other congruent units across the bilingual's languages such as cognate words which are processed faster than non-cognate words (Dijkstra, Grainger, & van Heuven, 1999; Kroll & Stewart, 1994; Macizo & Bajo, 2006), or congruent noun phrases across languages which are comprehended faster by bilinguals and translators (Ruiz et al., 2008).

Therefore, the idiom superiority effect found during the processing of congruent idioms suggests that there was an automatic co-activation of the bilingual's languages which benefited task performance when there was a match between the entries activated in the two languages. Nevertheless, keeping this co-activation in mind, when RTs relative to the processing-for-translation of incongruent idioms were analyzed, we observed differences between bilinguals and translators. Compared to bilinguals, translators showed significantly slower latencies in response to the secondary task while processing incongruent idioms. These results seem to indicate that the translators dedicated more cognitive resources to the processing of incongruent idioms relative to the bilinguals.

A plausible interpretation, supported by the Superlemma Model, for the translators' RT data in response to the tone when they processed incongruent idioms seems to be the simultaneous L1/L2 co-activation of both the idiomatic meaning and the word-by-word computation of the string. This concurrent co-activation would produce competition, reducing the cognitive resources available to perform the secondary task. This assumption is in line with the intrinsic properties of the professional translation task, which is, the need for maintaining active all the possible (and competing) translation solutions up to the very moment in which the uttering of the target language (TL) output can be legibly disambiguated by the linguistic context. This process results in a less automatized behavior (slower RTs) and higher levels of cognitive control exerted over the task, in such a way that a general slowdown is displayed in order to control the overall process (cross-linguistic co-activation and subsequent control of irrelevant information) and guarantee the high quality standards required by professional translation.

Once more, this interpretation suggests that translators involved cognitive control to regulate the activation of their two languages. This concurrent co-activation reduced the availability of cognitive resources to perform the secondary task in our experiment. It could be argued that the maintenance of active representations (word-by-word translation and idiomatic translation) could damage the translation process. However, this was not the case. Firstly, the analysis of accuracy in the retrieval of the target language superlemmas confirmed that the translators outperformed bilinguals in the quality of the translation task. They showed enhanced ability to retrieve the TL superlemma as a lexicalized unit (cross-linguistic lexical retrieval). Secondly, in order to differentiate lexical from semantic retrieval, we also analyzed the amount of conceptually-driven translations, which is, those translations for which the sense of the original idiom was retrieved and preserved, despite the fact that the exact TL superlemma was not available for production. Translators outperformed bilinguals also in cross-linguistic semantic retrieval. In other words, translators qualitatively outperformed bilinguals overall, and enjoyed direct access to the superlemma as a whole, both to its linguistic (accuracy analysis) and conceptual entity (semantic translation analysis).

Therefore, the co-activation of both the idiomatic meaning of the string and the word-by-word translation reduced cognitive resources in translators but increased the quality of their performance. Moreover, in translators, the maintenance of cognitive control over active representations of incongruent idioms was performed in a flexible manner. Given that translators co-activated the word-by-word translation and the idiomatic translation of incongruent idioms, they used the correct representations to translate incongruent idiomatic expressions. In fact, the amount of incongruent idioms erroneously translated literally (word-by-word translation) was reduced in translators compared to bilinguals. This observation also suggests that translators used a more direct route to retrieve translation equivalents at the superlemma level for these idioms, and seemed to adopt a more chunked and conceptually-driven approach to translation relative to the word-by-word approach preferred by the bilinguals. This implies that a direct and strong connection is available for translators between the L2 superlemma and the concept (Yamashita & Jiang, 2010), contrary to what is observed for the bilingual group. Bilinguals opted for the one-to-one correspondence between the individual lemmas comprised in the L1 and L2 idioms; this type of approach is dependent on the lexically-driven L1 mediation process.

There is another point worth mentioning, since it favors the interpretation that the differences observed in our study are due to how expert translators manage cognitive control processes as a consequence of domain expertise: it has been shown that bilinguals who switch frequently (such as translators) manage cognitive control resources in a different way (Green, 1998), in the sense that they take advantage from the activation of both languages in order to properly adapt morfosyntax of production (Green, 2011). The fluency of the morphosyntactic adaptation process (i.e., by means of which the correct TL superlemma of an incongruent idiom is retrieved) depends on timing and synchronization (Green, 2011; Kotz & Schwartze, 2010), in the sense that this is a process that requires matching and integrating the input to content elements in memory both in the L1 and L2 (Green, 2011). This assumption helps to further understand the patterns of result observed for translators (slower RTs and higher quality of translation): professionals manage control resources in a way that allows them to keep both languages active until the appropriate morphosyntax for production is available (the correct TL superlemma);

however, the process of matching and integrating in memory the SL superlemma against the incongruent TL superlemma requires a more delayed timing and synchronization.

Once again, considering the results included in Chapter V and the theoretical frameworks employed to interpret the data, the linguistic behavior adopted by translators in this experiment is attributable to a specific handling of the linguistic cognitive control mechanisms derived from translation expertise. Translators showed enhanced ability to flexibly adapt semantic contents cross-linguistically, employing the dual language co-activation as a means for rejecting the word-by-word approach to translation in favor of the selection of target forms that might function as cultural efficient equivalents of the meanings intended in the source language.

These data are coherent with the patterns observed in the ambiguity resolution task (Chapter IV) and in the memory search task (Chapter III): linguistic and cognitive flexibility seem to be a direct consequence of consistent training in translation tasks. Moreover, the between group comparisons carried out so far confirm the idea that the different cognitive demands imposed by different bilingual experiences modulate both linguistic control and executive control mechanisms.

At his point we wanted to consider bilingualism as a dynamic concept that included very diverse ecologies of bilingualism. Therefore, we contemplated the role played by the age of L2 acquisition in the retrieval of translation equivalents of figurative language. When early heritage bilinguals and late bilinguals were compared (Chapter VI), they showed a similar idiom superiority effect: The latencies for the tone detection task were faster when the tone was presented in congruent idiomatic expressions relative to their control sentences. As in the previous comparison, this facilitation effect confirmed co-activation of languages in both early and late bilinguals.

Importantly, differences between early and late bilinguals were found when they processed incongruent idioms. Compared to early bilinguals, late bilinguals showed significantly slower latencies in response to the secondary task while processing incongruent idioms for translation. As observed for the group of Translators in Chapter V, late bilinguals seemed to count on less available cognitive resources to perform the secondary task while processing incongruent idioms. As far as accuracy is concerned, no between-group differences were observed: both groups committed more errors when translating incongruent idioms compared to their controls. We again proposed that the slowing down of performance was due to the simultaneous co-activation (cross-linguistically) of both the idiomatic meaning and the word–by–word computation of the string.

Moreover, we observed a correlation between "AoA of English Basic skills", "age of active onset of bilingualism" and "RT to Incongruent Idioms".This pattern of results indicates that L2 learners are initially dependent on the L1 mediation process, which results in the processing advantage of congruent collocations and a word-by-word approach to the processing of incongruent idioms; however, increasing exposure to the L2 environment promotes direct and stronger links between L2 idioms and concepts, in such a way that L2 collocations are processed independently from the L1 lexicon. This interpretation is in line with the prediction of Kroll and Stewart (1994 – The Revised Hierarchical Model) and Sprenger et al. (2006 – The Superlemma Model) and the studies available on AoA and syntactic processing, that indicate that AoA is one of the most influencing factors of neural organization when syntactic processing is at play (Hernandez, Hoffman and Kotz, 2007; Saur et al., 2009; Wartenburger et al., 2003).

In our research, we adopted the assumption that the enhanced cognitive control shown by bilinguals in non-verbal tasks might determine the way by which they perform language processes. Note that this idea is a mirror image of previous research on the field in which it was examined whether differences in the linguistic domain impact general executive processes (e.g., Bialystok, Craik & Luk, 2008; Carlson & Meltzoff, 2008; Hernández, Costa, Fuentes, Vivas, & Sebastián-Gallés, 2010; Salvatierra & Rosselli, 2011). The results found in the present thesis corroborates our hypothesis in a clear-cut way by showing the link between bilingual idiomatic processing and the functioning of general cognitive control mechanisms that are not language-specific.

As mentioned, the reduced cognitive resources to perform the secondary task during the processing of incongruent idioms depended on the L2 age of acquisition. Moreover, we observed a close relationship between the processing of incongruent idioms and the costs in general cognitive tasks (i.e., the Flanker task). Concretely, conflict resolution (conflict vs. incongruent) in the flaker task correlated with the RTs to the secondary task while processing incongruent idioms, indicating that higher efficiency in cognitive control (smaller Flanker effect) was associated to higher availability of cognitive resources recruited to process incongruent idioms. This relationship is easily explained, since incongruent idiomatic processing between languages implies resolving conflicting information from competing cues (lemmas and superlemmas activated cross-linguistically) higher maintenance of the focus of attention on the target (superlemma) while ignoring the distracters (individual lemmas) during the processing of incongruent idioms.

Furthermore, we observed a correlation between the inhibitory index in the Flanker task (congruent vs. incongruent trials) and the tone detection task during incongruent idiom processing which might be interpreted as due to due to the inhibition of irrelevant information (single lemmas) to prevent interference during the processing of incongruent idioms. These two correlations are in line with the amount of incongruent idioms erroneously translated word-by-word. In this analysis, late bilinguals showed a preference towards the word-by-word translation over the superlemma translation relative to the early bilinguals, which implies that a more efficient idiomatic processing is linked to higher levels of conflict resolution (single lemmas and superlemma activation) and inhibition of non-relevant information (single lemmas activation). This observation replicates and expands previous research showing that bilingualism affects the performance of tasks that tap general attentional control mechanisms and that do not involve language use (e.g., Bialystok, 1999;

Bialystok, 2006; Bialystok & Martin, 2004, Experiment 1; Bialystok & Senman, 2004; Bialystok & Shapero, 2005).

Finally, there was a correlation between an index of monitoring control in the flanker task (control vs. congruent trials) and the RTs gathered for incongruent idiomatic processing, that could be interpreted as follows: more efficient idiomatic processing is linked to more powerful monitoring processes (for a similar interpretation see Bialystok, 2006). Note that this interpretation is also in line with the efficient monitory control with which participants handle the activation of syntactic cues depending on task goal (Chapter IV).

Translation expertise and varieties of bilingualism

In our research we adopted the view that bilinguals cannot be considered a categorical variable nor professional translation a separated entity. Instead, we assume the view that the use of languages in different interactional contexts determines a variety of bilingual expertise (Green & Abutalebi, 2013; Luk & Bialystok, 2013). However, when we put together the results found in some of our experiments a reader might look at the classical question about the difference between being a "regular bilingual" versus a professional translator. When we examined how monolinguals, bilinguals and translators performed a non-verbal task (memory search, Chapter III), we observed the same pattern of performance in translators and non-trained bilinguals. These similarities suggest that the balance between automaticity and control is actually due to second language use rather than to domain specific translation practice. The lack of significant differences between bilinguals and translators implies that, at least in terms of balance between automaticity and attentional control in non-verbal tasks, the overall cognitive benefits derived from natural, untrained bilingualism are equivalent to those due to training in translation.

When we move to the linguistic domain, we also observed similarities in the way bilinguals and translators managed cognitive resources during the comprehension of figurative language. Concretely, translators (Chapter V) and early bilinguals (Chapter VI) showed some similarities: they avoided the incorrect word-by-word translation of incongruent idioms which seems to indicate the efficient search of target translation equivalents at the superlemma level. However, when the quality of the translation process was considered, the only group that stood out for the degree of accuracy reached in the task, both at the lexical and semantic level, was that of translators. This indicates that training in translation guarantees the quality of the translation process.

The similarities found between early bilinguals and professional translators, however, should not force towards the conclusion that any bilingual can translate professionally. As Bialystok and Depape (2009) suggest, an interesting feature of the cognitive advantage linked to bilingualism is that the same cognitive advantage is also found in other domains than bilingualism (e.g., musical expertise), emphasizing the role of domain- general mechanisms. Therefore, very different experiences can engage the same general cognitive mechanisms, although through requirements that are specific to those experiences (in our case, bilingualism vs. translation) (Bialystok & Depape, 2009).

Probably, the continuous use of two or more languages in many different interactional contexts might force both bilinguals and translators to maintain a sustained control over their languages. Some commonalities can be found in the way cognitive control is exerted by bilinguals and translators in both linguistic and non-linguistic tasks. However, several studies clearly indicate the different use of cognitive processes by trained and non-trained bilinguals (monitoring, in Yudes, Macizo, & Bajo, 2011; attentional regulation, in Morales, Padilla, Gómez-Ariza, & Bajo, 2015; language switching, in Ibáñez, Macizo, & Bajo, 2010).

The challenge for the future is to isolate specific control processes that are contingent on interactional linguistic and non-linguistic contexts. Other questions might be asked, whose answers would be important both in the domains of bilingualism and translation expertise: Could biculturalism be another important factor in predicting cross-linguistic performance in translation? Does the cultural (thus, conceptual) similarity between the two languages of bilinguals have an impact on the linguistic transfer or adaptation underlying efficient translation activity? What the perfect balance between automaticity and cognitive control should be in order to ensure efficient retrieval of linguistically and culturally equivalent translation solutions? Answers to these questions could help to disentangle all the variables having an impact on the efficiency of the linguistic cognitive mechanisms that do play a role in bilingual competence and translation expertise.

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CHAPTER VIII

APPENDICES

APPENDIX A

Language History Questionnaire used in the Experiments

(Adapted from Li, Sepanski, & Zhao, 2006)

- Name
- Current age
- Gender
- Years of language instruction
- Highest Degree achieved
- Onset of Active Bilingualism (on a daily basis):
  1) Home 2) School 3) Other daily life activities:
- Years of residence L1 country
- Years of residence L2 country
- Age of Acquisition L1 abilities:
  1) Reading 2) Writing 3) Speaking 4) Listening
- Age of Acquisition L2 abilities:
  1) Reading 2) Writing 3) Speaking 4) Listening
- Reading ability L1 (Likert 1-10)
- Speaking ability L1 (Likert 1-10)
- Writing ability L1 (Likert 1-10)
- Listening ability L1 (Likert 1-10)
- Reading ability L2 (Likert 1-10)
- Speaking ability L2 (Likert 1-10)
- Writing ability L2 (Likert 1-10)
- Listening ability L2 (Likert 1-10)
- Language spoken at home
- Native language
- Language at school
- Years in a foreign school
- Native country
- List of known languages
- Overall number years using L2
- L2 overall proficiency
- Age of arrival/immersion (aoa)
- % daily use of L2
- % daily use of L1
- Preferred language
- Setting of acquisition (L1, L2)
- Status of immersion (High, Medium, Low)
- Language used when socializing
- Travel to L2 country
- Reading dominance
- Speaking dominance
- Understanding dominance
- Writing dominance
- Hours/day of radio/tv in L2

- Language(s) parents speak
- Frequency of speaking L1/L2 at home
- Frequency of speaking L1/L2 at work
- Frequency of speaking L1/L2 with friends

APPENDIX B

Experimental material used in Chapter IV

- La radio anunció el compromiso del príncipe que era apoyado por sus padres
- Aquellos hombres operaron al bebé de la marquesa que tenía los ojos enormes
- La turista encontró a las profesoras de los chicos que vivían en el extranjero hace tiempo
- Mis amigos viajaron en el coche de la hermana que vimos en la plaza del pueblo
- Ese muchacho tropezó con la mochila de la joven que se había perdido en el parque
- El helicóptero trasladó al tío del obrero que tenía 40 años recién cumplidos.
- El camarero cobró a la novia del marinero que pasaba mucho tiempo aseándose en el baño.
- El médico operó la herida del futbolista que tenía una pinta horrible antes de la intervención.
- Aquella enciclopedia reúne fotos de flores que costaban mucho dinero en el pasado
- La alarma sonó en la tienda del joyero que gustaba mucho a las mujeres del lugar
- El peluquero atendió al gemelo del jefe que tenía una mujer ciega de nacimiento
- El dentista atendió a la secretaria de la directora que se había divorciado de su marido

- El colegio contrató a la socia de la empresa <u>que ofrecía cursos de piano en el periódico</u>
- El arquitecto diseñó la casa del carpintero <u>que estaba en el campo cerca de la gasolinera</u>
- Aquel camión reparte la mercancía del fabricante <u>que pesa 80 Kg. como mucho</u>
- La supervisora consultó a los clientes de los empleados <u>que se habían tomado unas vacaciones</u>
- El cocinero horneó la tarta de la ministra <u>que se cayó por las escaleras de la entrada</u>
- La serpiente mordió al ayudante del explorador <u>que celebró una fiesta en el barco</u>
- El taxista llevó al hijo del japonés <u>que era un abogado de prestigio en una gran ciudad</u>
- El museo expuso la obra del artista <u>que desapareció el siglo pasado en Roma</u>
- Ese libro cuenta la tragedia de la africana <u>que conocimos por televisión el martes</u>
- La modista vistió a la madrina del carnicero <u>que escribía poesía desde la infancia</u>
- El político visitó al enfermo del hospital <u>que era famoso en el mundo entero</u>
- El jardinero regó las rosas de los maceteros <u>que regalamos a los vecinos el otro día</u>
- El presidente felicitó a los estudiantes de las escuelas <u>que habían recibidos una gran cantidad de premios</u>
- El obispo saludó al padre del alcalde <u>que llevaba una pierna escayolada hasta la cadera</u>
- El jinete colocó la silla del caballo <u>que le regalaron aquí hace un par de años</u>
- Muchos compraron la película del actor <u>que tuvo tanto éxito el año pasado</u>
- El viento dobló las palmeras de las playas <u>que tenían un nombre muy poco común</u>
- Aquel hombre navegó en la embarcación de la mujer <u>que era de origen holandés</u>

- Ese cantante se casó con la cuñada de la vecina que nació en América hace 18 años
- Un gorila atacó a la dueña de la iguana que estaba cerca aquella tarde.
- El payaso divirtió a los niños de los invitados que visitaron el museo más antiguo de la capital
- El detective acudió al médico del juez que era aficionado a la pintura hace años
- El sargento interrogó al ladrón de la monja que conducía un coche blanco recién estrenado
- Ese camionero transporta las vacas de los ganaderos que han enfermado por comer demasiado

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- El médico recetó una medicina a la mujer enferma
- El examen que hizo Ángel era de gran calidad
- El camarero del mesón sirvió la copa de vino a Rosa
- Las rosas rojas desprenden un suave aroma que le gusta a Ana
- El ciprés de la esquina es más alto que el nogal de la plaza Mayor
- Luisa cocinó tortilla de patatas para su hermana Rocío
- La cerveza que nos sirvieron estaba más fría que el vino
- El puesto de trabajo en la empresa de Juan está bien remunerado
- El cristalero que puso las ventanas de la casa de José estaba muy fuerte
- La puerta de la casa que tienen tus padres es de color rojo
- María llamó por teléfono al presidente de la comunidad de vecinos
- El profesor con bigote y traje de chaqueta habló con el padre del niño
- El café estaba más amargo que el té que nos pusieron para la merienda

- El pasillo del hospital es demasiado estrecho y dificulta la entrada de los pacientes
- Me compraron un coche grande con ruedas de color blanco
- Pusimos la caja de madera en la estantería del cuarto de estudio
- El cuarteto de cuerda interpretó sonatas de violín compuestas por Bach
- El amigo de mi novia escribe novelas de ficción en un ordenador portátil
- Su foto no salió en la televisión pero la vi en el periódico
- El padre de Carlos estudió en un colegio privado con profesores americanos
- La pastilla contra el dolor estaba en el bote redondo
- Elena puso las cortinas de seda en la bolsa de la ropa sucia
- El arroz tenía más sal que la salsa de ostras
- El estudiante se enfadó con el empleado de la tienda
- Compraron una raqueta de madera y una pelota de goma para jugar al tenis
- La hija de Antonio estuvo en Italia el verano pasado

APPENDIX C

Experimental material used in Chapters V and VI

INCONGRUENT IDIOMS (ENGLISH)	CONTROL SENTENCES	*IDIOMATIC EQUIVALENTS IN SPANISH*
An apple never falls far from the tree	The apple did not fall far from where I was	*De tal palo tal astilla*
Don't put all your eggs in one basket	Don't put all the eggs in the fridge	*No pongas toda la carne en el asador*
Every cloud has a silver lining	Every cloud has a specific chemical composition	*No hay mal que por bien no venga*
Half a loaf is better than no bread	A half loaf of bread is better than eating trash foods	*Algo es algo, menos es nada*
The old man came dressed up to the nines	The old man came dressed up to the party	*De punta en blanco*
He was caught in the act	He was caught in the supermarket	*Cogido con las manos en la masa*
He was as happy as a clam	He was as happy as a child on his first day of vacation	*Feliz como una perdiz*
It never rains, it pours	In this place it never rains, but it snows	*Las desgracias nunca vienen solas*
Like a bear with a sore head	The bear had a sore paw	*Humor de perros*
That guy doesn't have a pot to piss in	The guy did not have a pot to cook in	*No tener donde caerse muerto*
Rome was not built in a day	Rome was not built in a strategic area	*Zamora no se ganó en una hora*
She met her maker yesterday	She met her boss yesterday	*Pasar a mejor vida*
The coast is clear here	The coast in clean here	*No hay moros en la costa*
The grass always looks greener on the other side	The grass always looks better on this part of the garden	*Gusta lo ajeno más por ajeno que por bueno*
They are birds of a feather	Birds of a species fly together	*Tal para cual*
They told him a cock and bull story	They were reading a cock and bull fairytale	*Cuento chino*
Joanna bit my head off last night	The zombie bit his head in the last episode on TV	*Echarle la bronca a alguien*
He burns the midnight oil	The priest was burning the midnight incense	*Quemarse las pestañas*
He is the one who calls the shots	He is the one who calls the employees	*El que corta el bacalao*
He cashed in his chips before his birthday	He changed his cash for color chips at the Casino	*Irse al otro barrio*
They are just chewing the fat all the time	The dog was chewing the fat offcuts that were on the floor	*Estar de palique*
I'm going to cook his goose	I'm going to cook the	*Hacerle la Pascua a alguien*

	goose in the oven	
She should not cry over spilled milk	She started to cry as she spilled the milk	*A lo hecho, pecho*
Keep trying, but it's like flogging a dead horse	He flogged the poor little horse	*Como predicar en el desierto*
The secretary hit the bull's eye	The young boy hit the bull's back at the bullring	*Dar en el blanco*
The old man hit the ceiling last night	The ceiling was hit by the workers	*Perder los estribos*
John hit the nail during the meeting	John hit his nail against the wall	*Dar en el clavo*
Mary kicked the bucket yesterday	The kids kicked the car again last night	*Estirar la pata*
Don't let the cat out of the bag	Don't let the cat out of the house	*Irse de la lengua*
You cannot make a silk purse out of a sow's ear	She made a silk purse out of old clothes	*Pedir peras al olmo*
He always pulls my leg	He pulled her leg towards himself	*Tomar el pelo*
We should not spill the beans	The girl spilled the coffee	*Irse de la lengua*

CONGRUENT IDIOMS (ENGLISH)	***CONTROL SENTENCES***	***IDIOMATIC EQUIVALENTS IN SPANISH***
It's like looking for a needle in a haystack	I'm looking for a needle to darn my sock	*Buscar una aguja en un pajar*
We should take the bull by the horns	We bought these natural bull horns in Texas	*Coger el toro por los cuernos*
I had a lump on my throat	I had a lump on my head	*Tener un nudo en la garganta*
Melissa is the one who wears the pants in her family	Melissa is the only girl who wears the pants tonight.	*Llevar los pantalones*
All that glitters is not gold	It glitters, but it's not gold.	*No todo lo que reluce es oro*
You're playing with fire	He's playing with me	*Jugar con fuego*
He broke my heart	He broke my mug	*Romperle el corazón a alguien*
All roads lead to Rome	All roads lead to city centre	*Todos los caminos llevan a Roma*
I throw in the towel	I'll throw in a towel for free if you by the socks	*Tirar la toalla*
An open door may tempt a saint	An open door may tempt a burglar	*Puerta abierta al santo tienta*
I think we are on the same boat	I think we are on the same flight	*Estar en el mismo barco*
The guy has one foot in the grave	The guy has one foot in the water	*Tener un pie en la tumba*
You should button your mouth	You should button your jacket	*Callarse la boca*
It's on the tip of my tongue	Miniature pottery fits on	*En la punta de la lengua*

	the tip of your finger	
He's resting on his laurels	He's resting on his sofa	*Dormirse en los laureles*
It's like talking to a brick wall	It's like talking to my mum	*Como hablarle a la pared*
Love is blind	Love is complicated	*El amor es ciego*
He killed two birds with one stone	He killed two birds with an airgun	*Matar a dos pajaros de un tiro*
You should run the risk	You should run the marathon	*Correr el riesgo*
He's the black sheep of the family	The black sheep is running over there	*Ser la oveja negra de la familia*
I will put my cards on the table	Your cards are on the desk	*Poner las cartas sobre la mesa*
This problem is just the tip of the iceberg	The cap included in the box fits on the tip of the valve	*La punta del iceberg*
A matter of life and death	It is a matter of social justice and of good governance	*Cuestión de vida o muerte*
I know it's not the end of the world	I know it's not the end of our romance	*No es el fin del mundo*
We served it on a silver platter	We served it on a pottery platter	*Servir en bandeja*
Prevention is better than cure	Prevention is better than having to use military means afterwards.	*Más vale prevenir que curar*
Time cures all wounds	Time required for wound healing varies	*El tiempo cura todas las heridas*
He who laughs last laughs longest	He who laughs often is happier than the rest of us	*El que ríe el último, ríe mejor*
Mark planned to stab her in the back	Mark planned to stab her in the chest	*Apuñalar por la espalda*
My sister has her feet on the ground	My sister had her feet on the dashboard	*Tener los pies en el suelo*
Better late than never	Better to arrive sooner rather than late	*Mejor tarde que nunca*
They killed him in cold blood	Rinse several times in cold water	*Matar a sangre fría*

NON-IDIOMATIC FILLER SENTENCES

- A bite is a wound received from the mouth of an animal, including humans.
- A group of people trapped in an elevator realize that the devil is among them.
- Language is thought to have originated when early hominids first started cooperating.
- Nine is the natural number following 8 and preceding 10.
- Pots and pans need to conduct heat well.

- Powder is a material composed of very fine particles not cemented together.
- Rain is liquid precipitation, as opposed to non-liquid kinds of precipitation such as snow.
- Rates for major crimes continue to fall in the city.
- Rome is the capital of Italy and the country's largest city.
- Scientists have identified processes that reveal the superb efficiency of natural systems.
- The bull has long been an important symbol in many cultures.
- The debt-reduction commission has purposely done little to date.
- The delineation of the extents of a coast differs according to jurisdiction.
- The gray wolf inhabits a reduced portion of its former range.
- The Hotel Monaco is a stylish alternative to bed-and-breakfasts and chain hotels.
- The largest producer of dairy products and milk today is India.

IDIOMATIC FILLER SENTENCES

- A bird in the hand is worth two in the bush.
- Brain is better than brawn.
- Out of sight, out of mind.
- One man's meat is another man's poison.
- As you sow, so shall you reap.
- If you buy cheaply, you pay dearly.
- Let sleeping dogs lie.
- You can’t teach an old dog new tricks.
- When the cat is away the mice will play.
- The end justifies the means.
- Beauty is in the eye of the beholder.
- Best things in life are free.
- Appetite comes with eating.
- Like water off a duck's back.
- You can judge a man by the companies he keeps.
- What can't be cured must be endured.

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«Considerate la vostra semenza:
fatti non foste a viver come bruti,
ma per seguir virtute e canoscenza»

Dante Alighieri, La Divina Commedia,
Inferno, Canto XXVI, vv. 118-120.

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