VNIVERSITAT DE VALÈNCIA

FACULTAD DE PSICOLOGÍA

DOCTORADO EN INVESTIGACIÓN EN PSICOLOGÍA

EMBODIED EFFECTS OF POSTURE: CHANGING EMOTIONAL AND COGNITIVE PROCESSES THROUGH THE BODY

TESIS DOCTORAL

Presentada por:

Marta Miragall Montilla

Dirigida por:

Dra. Rosa Mª Baños Rivera

Dra. Ernestina Etchemendy Kasten

Mayo, 2018

This dissertation was supported by the Ministry of Economy and Competitiveness of Spain under the grant “Programme for the Training of Researchers” (Formación de Personal Investigador, FPI), with the reference number BES-2012-056497.

Acknowledgments / Agradecimientos

En estas líneas me gustaría hacer un agradecimiento especial a todas las personas que han contribuido de alguna forma a la realización de esta tesis doctoral y a mi formación como investigadora.

Quiero hacer un especial agradecimiento a Rosa. Gracias por transmitirme la pasión por investigar, por enseñarme a plantearme retos, hacerme preguntas y responderlas, por ayudarme a perder miedos, por hacerme crecer como investigadora, y por estar ahí siempre que lo he necesitado. GRACIAS.

También me gustaría agradecer a Ernes su apoyo en este proceso, por estar en los momentos clave, por contagiarme de sus emociones positivas, y por tomarse el tiempo que hiciera falta para reflexionar juntas.

Además, me gustaría hacer una mención muy especial a Ausiàs. Gracias por guiarme en mi crecimiento como investigadora, y por tener siempre un momento para aclararme dudas, orientarme en mi futuro, y ayudarme a conectar con el presente en los momentos más difíciles.

Y como no, quiero agradecer a tod@s mis compañer@s que conforman "la familia Labpsitec". Gracias por compartir proyectos, por haberme resuelto dudas, por empujarme a resolverlas sola, por aconsejarme, por las risas, por contar conmigo, por el entusiasmo que se percibe en el laboratorio, por las palabras de ánimo que se reciben sin apenas pedirlas, y por superarnos juntas a diario. Además, quería hacer un agradecimiento especial a Alba, Lola, Jessica y Ro, que han sido mis pilares fundamentales en esta última etapa. Gracias por vuestro apoyo incondicional, por nuestras conversaciones, por resolver incertidumbres juntas, y por convertiros en mis amigas. Trabajar con vosotras a diario ha sido un regalo.

También quiero agradecer a todos los profesores que me dejaron entrar en sus clases para pasar cuestionarios, y como no, a los participantes que quisieron formar parte de los estudios de esta tesis.

Además, me gustaría agradecer a mi familia. Papás, gracias por enseñarme a ser perseverante en las cosas que emprendo, a intentar hacer las cosas lo mejor posible, a no rendirme, y a buscar soluciones ante los obstáculos. Gracias por incentivar mi formación y ayudarme en todo lo que está a vuestro alcance. Y por supuesto, a mi hermana y a mi cuñado, que siempre han estado presentes, apoyándome desde la distancia. Os quiero. Y no quiero olvidarme de mi suegra, gracias por sus palabras de ánimo en los momentos de estrés, por su mirada llena de empatía y por las conversaciones "psicológicas".

Quiero agradecer a mis amigos "Los Psicos", ya que con ellos empezó toda mi pasión por la Psicología. Gracias por nuestras quedadas de desconexión, por las risas, por escucharme cuando os contaba mis estudios, por alegraros de mis logros, y por vuestras palabras de ánimo cuando lo necesitaba.

Por último, me gustaría agradecer a mi pareja su apoyo incondicional. Por leer todos mis artículos, por darme su opinión y aconsejarme, por enseñarme a hacer mis primeros análisis de estadística, por sus palabras y abrazos de ánimo, por su comprensión y paciencia infinita durante el proceso de escritura de la tesis, por los largos paseos "anti-estrés" con Shasha que han inspirado los diseños y discusiones de los estudios de la tesis, y en definitiva, por ayudarme en todo lo que ha podido.

Gracias a tod@s por la felicidad que siento ahora mismo.

INDEX

INDEX OF FIGURES

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

INDEX OF TABLES

CHAPTER 2

CHAPTER 3

CHAPTER 4

SUMMARY IN SPANISH/ RESUMEN EN ESPAÑOL

1. Introducción

1.1. Cognición y emoción encarnada

El concepto de cognición encarnada podría definirse como "un efecto donde el cuerpo, su estado sensoriomotor, su morfología, o su representación mental juega un papel instrumental en el procesamiento de la información" (Körner, Topolinski, y Strack, 2015, p.1). Esta definición fenomenológica incluye un principio fundamental de la cognición encarnada o emoción encarnada recogido en diversas definiciones: el procesamiento de la información es una actividad que no se encuentra separada del cuerpo, ya que tanto los procesos cognitivos como los emocionales están fuertemente influenciados por el cuerpo, incluyendo su morfología, sus sistemas sensoriales y sus sistemas motores (p.ej., Glenberg, 2010; Glenberg, Witt, y Metcalfe, 2013; Winkielman, Niedenthal, Wielgosz, Eelen, y Kavanagh, 2015). Por lo tanto, los conceptos de cognición encarnada o emoción encarnada sugieren que las cogniciones y las emociones están encarnadas, y consecuentemente, el procesamiento de información no constituye una actividad separada de los procesos corporales como la propiocepción o los movimientos corporales.

El cuerpo y sus procesos implicados han recibido poca atención dentro de las teorías del procesamiento cognitivo que han dominado las últimas décadas. Así pues, las teorías cognitivas tradicionales del procesamiento de la información desarrolladas entre la década de los sesenta y ochenta aproximadamente (p.ej., Anderson, 1983; Lang, 1979; Newel & Simon, 1976), consideraban que la mente era un procesador abstracto de información, donde el papel del cuerpo y la información proporcionada por éste eran totalmente irrelevantes. Estas teorías consideran que después de experimentar un estado emocional (p.ej., felicidad), la representación cognitiva de la emoción se "desencarna" en nuestra mente, la información sensorial es eliminada (p.ej., la experiencia de sentirse

feliz) y es representada en nuestra mente como una proposición (p.ej., "me siento feliz") que es almacenada en nuestra memoria en forma de símbolos abstractos. Así pues, el "modelo de sándwich" es el que impera en dichas teorías (Hurley, 2001), ya que se considera que la cognición se encuentra en un módulo, que es independiente de los procesos perceptivos o motores, es decir, del cuerpo. Consecuentemente, la mente es considerada como una especie de sándwich, donde la cognición se sitúa entre la percepción y las acciones. Por tanto, el cuerpo forma parte de un módulo que no puede interactuar con la cognición.

En contraposición, en los últimos años se ha producido un cambio radical en la forma de entender el procesamiento de la información. La evidencia empírica señala que el cuerpo ejerce una gran influencia en la conformación de nuestros pensamientos y emociones. Estos hallazgos se enmarcan en las teorías de la cognición encarnada (p.ej., Barsalou, 2008; Niedenthal, 2007), en las cuales el supuesto básico es que el procesamiento de la información se encuentra influenciado, asociado, y a veces dependiente, de recursos perceptivos, somatosensoriales y motores (Winkielman et al., 2015). Por lo tanto, estas teorías asumen que la cognición o el procesamiento de la información puede depender de estados corporales y acciones físicas. Así pues, los estados cognitivos pueden influenciar los estados corporales asociados, y a la inversa (Barsalou, 2015). Por lo tanto, desde estas teorías se sugiere que el cuerpo −que tengamos cara, cabeza, brazos, torso o piernas− influye en nuestras experiencias sensoriales y motoras, contribuyendo así en la construcción de las bases del procesamiento de información, tanto a nivel afectivo (p.ej., produciendo emociones determinadas) como a nivel cognitivo (p.ej., produciendo actitudes, pensamientos o juicios específicos).

Por otra parte, existen otras teorías que se engloban bajo el nombre de *Grounded Cognition*, como la teoría de Sistemas de Símbolos Perceptivos (*Perceptual Symbol*

Systems, Barsalou, 1999) o la Acción/Cognición Situada (*Situated Action/Cognition*, Smith y Semin, 2004), que amplían el enfoque de las teorías de cognición encarnada. Estas teorías consideran que la cognición puede estar influenciada por estados corporales, pero que, en ocasiones, la cognición puede generarse independientemente de los estados corporales a partir de otros procesos (p.ej., a partir de simulaciones mentales de estados corporales previos). Asimismo, otra teoría que se engloba dentro del enfoque de *Grounded Cognition*, es la teoría Lingüística Cognitiva de Lakoff y Johnson (1980; 1999), que señala que parte de nuestro lenguaje −los conceptos abstractos− se asocian en forma de metáforas a un conocimiento "encarnado" (p.ej., el pensamiento abstracto sobre moralidad se asocia a la experiencia de limpieza física). Así pues, el uso de metáforas indica el modo en el que las personas representan y piensan sobre los conceptos abstractos, y este modo de representar el pensamiento es el resultado de la interacción entre el cuerpo y el mundo.

Cabe mencionar que en la presente tesis doctoral se asumirá una perspectiva no radical de las teorías de cognición encarnada. Así pues, se considera que el cuerpo proporciona información valiosa y sofisticada en la cognición, que es usada en algunas ocasiones, pero no siempre. Es decir, los estados corporales representan un factor más que puede contribuir al procesamiento de la información, pero no el único. Glenberg et al. (2013) afirma que considerar que el cuerpo está presente cuando sentimos, pensamos, o actuamos, nos llevará a un marco conceptual de la psicología más unificado, útil y comprensivo. De hecho, Glenberg (2010) sugiere que los principios de cognición encarnada se pueden aplicar a todos los campos de la psicología, incluyendo la psicología clínica.

Por último, cabe resaltar el enfoque parsimonioso que proponen Körner et al. (2015) para dilucidar los mecanismos que podrían estar a la base de los efectos de los

estados o procesos corporales en el procesamiento de la información. Así pues, estos autores sugieren tres mecanismos automáticos con distintas propiedades y consecuencias, que pueden actuar por separado o conjuntamente, y que permiten explicar todos los efectos psicológicos "encarnados" que se encuentran en los estudios enmarcados dentro de las teorías de cognición encarnada:

(1) Mecanismo 1: Inducción directa de un estado determinado. Los estados corporales alteran directamente el estado mental, los sentimientos o el procesamiento de la información (p.ej., los estados afectivos o no afectivos) de los individuos, y no están mediados por otros mecanismos cognitivos, como las atribuciones o inferencias conscientes (p.ej., sonreír induce un estado de felicidad).

(2) Mecanismo 2: Efecto de facilitación modal. Los estados corporales alteran la disponibilidad de información o contenido específico en la mente. Así pues, la manipulación del cuerpo aumenta la accesibilidad a conceptos asociados (p.ej., sonreír activa conceptos relacionados con la diversión o la felicidad), ya que se presupone que las representaciones mentales de los conceptos contienen aspectos específicos de tipo motor y sensorial.

(3) Mecanismo 3: Simulación sensoriomotora. Los estados corporales pueden complementarse con simulaciones mentales automáticas concurrentes que afectan el procesamiento de la información, el juicio y el comportamiento (p.ej., sonreír o impedir sonreír, junto a la simulación mental de una sonrisa que se produce cuando se está evaluando un estímulo divertido, puede facilitar o impedir la evaluación de dicho estímulo como divertido). La simulación automática es una reactivación parcial de la acción o la sensación experimentada que utiliza las mismas regiones neuronales que cuando éstas son experimentadas realmente. Por ello, la simulación puede tener lugar

cuando el estado físico simulado, las sensaciones o las acciones están ausentes y no están siendo experimentadas realmente.

1.2. Estudios enmarcados en las teorías de la cognición encarnada

Una revisión llevada a cabo por Price, Peterson, y Harmon-Jones (2012) respalda la relación bidireccional entre los procesos corporales y los procesos emocionales y cognitivos. Así pues, diversos estudios experimentales proporcionan apoyo empírico a dicha relación bidireccional a través de la manipulación de la expresión facial (p.ej., Havas, Glenberg, Gutowski, Lucarelli, y Davidson, 2010; Niedenthal, Winkielman, Mondillon, y Vermeulen, 2009; Wollmer et al., 2012), los movimientos del brazo (p.ej., Cacioppo, Priester, y Berntson, 1993; Föster, 2003; Wiers, Eberl, Rinck, Becker, y Lindenmeyer, 2011), los movimientos de la cabeza (p.ej., Wells y Petty, 1980; Rahona, Ruiz Fernández, Rolke, Vázquez, y Hervás, 2014), la forma de caminar (p.ej., Michalak et al., 2009; Michalak, Rohde, y Troje, 2015; Peper y Lin, 2012) y la postura corporal (p.ej., Cuddy, Schultz, y Fosse, 2018).

Debido a que el foco de la presente tesis doctoral está centrado en el análisis de los efectos psicológicos de la postura corporal, a continuación, se explican con más detalle los estudios más relevantes en cuanto al efecto de posturas erguidas y expansivas (*versus* posturas encorvadas y contraídas). No obstante, para facilitar la comprensión de dichos estudios, se clarificarán las diferencias entre ellos y se explicarán sus características generales. En primer lugar, cabe señalar las diferencias que existen entre los estudios que manipulan la postura erguida (*versus* encorvada) de aquellos que manipulan la postura expansiva (*versus* contraída). Los estudios experimentales que manipulan la postura erguida (*versus* encorvada) hacen hincapié en que los participantes mantengan la espalda y el cuerpo erguido, eleven el mentón, y mantengan los hombros hacia atrás (p.ej.,

Michalak, Mischnat, y Teismann, 2014). Por el contrario, los estudios que manipulan la postura expansiva (*versus* contraída) hacen hincapié en la amplitud del espacio ocupado por las extremidades del cuerpo o en la apertura del cuerpo (p.ej., Carney, Cuddy, y Yap, 2010). En segundo lugar, cabe resaltar que no hay acuerdo entre los estudios en cuanto a la duración de adopción de la postura (p.ej., puede variar de 1 minuto a 30 minutos); el momento concreto en el que se adopta la postura (p.ej., si se adopta antes y/o durante la tarea experimental); si la postura se adopta mientras los participantes están sentados o de pie; o si se cuenta una *cover story* (o historia que sirve como "tapadera") para encubrir a los participantes los efectos esperados de la postura (Carney, Cuddy, y Yap, 2015). Sin embargo, el procedimiento más común es que los participantes adopten la postura corporal durante un corto período de tiempo, siguiendo las instrucciones verbales del investigador, y sin tener conocimientos de los efectos esperados de adoptar una postura corporal específica. A continuación, se presentan los estudios de postura corporal más relevantes para justificar los estudios experimentales realizados en la presente tesis doctoral.

Una amplia evidencia empírica sugiere que adoptar una postura expansiva y/o erguida (*versus* encorvada y/o contraída) tiene efectos positivos en procesos emocionales, cognitivos, comportamentales y fisiológicos. Así pues, las posturas expansivas y erguidas se han relacionado con una mayor sensación de poder, una mayor tendencia al riesgo en una tarea experimental, y cambios hormonales asociados con un mayor dominio o control de la situación (testosterona) y un menor estrés (cortisol) (Carney et al., 2010); un mejor rendimiento general durante una entrevista de trabajo –simulada, pero estresante–, debido a un mejor comportamiento no verbal (mayor autoconfianza) (Cuddy, Wilmuth, Yap, y Carney, 2015); una mayor confianza en los atributos personales positivos generados por los propios individuos (Briñol, Petty, y Wagner, 2009); así como una mayor autoestima,

mayor activación fisiológica, estado de ánimo más positivo, una menor emoción de miedo, y más palabras verbalizadas (especialmente positivas) durante un discurso oral altamente estresante (Nair, Sagar, Sollers, Consedine, y Broadbent, 2015). Además, un reciente metaanálisis bayesiano de estudios prerregistrados ha demostrado que existe una relación significativa entre la adopción de una postura expansiva y el incremento de la sensación de poder autoinformado (Gronau et al., 2017). En la misma línea, una revisión sistemática de estudios relacionados con los efectos de la postura corporal utilizando análisis *p-curve*, revelaron un fuerte apoyo empírico para los efectos de las posturas corporales expansivas y erguidas en el incremento de la sensación de poder, así como en otras emociones, afectos y autoevaluaciones (Cuddy et al., 2018).

Asimismo, las posturas erguidas (*versus* encorvadas) se han relacionado con cambios en los sesgos de procesamiento de la memoria, que pueden estar a la base del desarrollo y mantenimiento de algunos trastornos mentales. En un estudio realizado por Michalak et al. (2014) se pidió a los participantes diagnosticados con trastorno depresivo mayor que crearan una escena visual relacionada con palabras positivas (p.ej., “disfrute”) y negativas (p.ej., “agotamiento”). Para ello, tenían que imaginarse a ellos mismos en dicha escena (p.ej., una escena en la que se sentían agotados) mientras mantenían una postura erguida o encorvada. Tras una tarea de distracción, se observó que los participantes sentados en una postura encorvada recordaron más palabras negativas, mientras que los participantes sentados en una postura erguida mostraron un recuerdo equivalente de palabras positivas y negativas. De modo similar, otros estudios con muestras no clínicas han mostrado resultados similares. Por ejemplo, Wilson y Peper (2004) evaluaron si era más fácil generar recuerdos de eventos pasados positivos y negativos en una postura corporal erguida o encorvada, encontrando que los eventos pasados positivos eran más fáciles de recordar en la postura erguida. Posteriormente, Tsai,

Peper, y Lin (2016) registraron los patrones electroencefalográficos de individuos durante el recuerdo de eventos positivos y negativos mientras mantenían una postura erguida o encorvada. Se encontró que el recuerdo de eventos positivos requería más esfuerzo o activación cortical en una postura encorvada (en comparación con una postura erguida).

Por último, cabe mencionar que la postura adoptada parece tener diferentes efectos sobre los síntomas emocionales que pueden surgir en los trastornos emocionales. Wilkes, Kydd, Sagar, y Broadbent (2017) encontraron que la postura erguida (en comparación a la postura natural adoptada por la persona) puede contribuir al aumento del afecto positivo, la reducción de fatiga y la disminución de la autofocalización excesiva en un discurso oral en personas con depresión de leve a moderada. En la misma línea, Veenstra, Schneider, y Koole (2016) concluyeron que la postura puede desempeñar un papel importante en la recuperación de un estado de ánimo negativo. Los participantes que adoptaron una postura encorvada (*versus* erguida) se recuperaron en menor medida de una inducción de estado de ánimo negativo. Además, este hallazgo se mantuvo independientemente de si los participantes intentaban regular sus emociones a través de la estrategia de reevaluación cognitiva.

En resumen, se puede concluir que existe una fuerte evidencia empírica respecto a los efectos positivos de las posturas expansivas y/o erguidas (*versus* contraídas y/o encorvadas) en los procesos cognitivos, emocionales y conductuales. Sin embargo, hasta la fecha, existe escasa evidencia sobre cómo un terapeuta puede usar la postura corporal durante la terapia. Por ejemplo, todavía se desconoce qué postura corporal es la adecuada para cambiar un resultado específico, en qué momento es recomendable usarla, o durante cuánto tiempo debe una persona mantener la postura.

1.3. El cuerpo en psicología clínica

La inclusión del cuerpo en modelos psicopatológicos explicativos de los trastornos mentales ha sido casi inexistente. En esta tesis se presentan dos modelos que han resaltado la importancia de los procesos corporales en el desarrollo y mantenimiento de la sintomatología de los trastornos mentales –principalmente dirigidos a explicar la depresión–. Estos modelos son el modelo de Subsistemas Cognitivos Interactivos (*Interacting Cognitive Subsystems*) (Barnard y Teasdale, 1991; Teasdale y Barnard, 1993) y el Modelo de Simulación de Metáforas (*Metaphor Simulation Model*) (Lindeman y Abramson, 2008). Así pues, el modelo de Subsistemas Cognitivos Interactivos es un modelo teórico integral de la organización y de las funciones de los distintos recursos subyacentes a la cognición. Según este modelo, existen varios subsistemas cognitivos especializados en el manejo de información de diferentes tipos. Uno de ellos es el "subsistema implicacional", que está directamente relacionado con la emoción, y codifica modelos esquemáticos que procesan niveles de significados implícitos, genéricos e integrales (p.ej., visión global negativa del yo o del futuro). Este sistema integra información de otros dos subsistemas: el "subsistema proposicional", que codifica significados específicos, explícitos, fácticos o conceptuales (p.ej., si uno ha cometido errores recientemente); y el "subsistema de los estados corporales", que codifica las entradas sensoriales del gusto, el olfato, tacto, dolor y propiocepción (p.ej., si la postura es erguida o encorvada, o si se está frunciendo el ceño o sonriendo). De acuerdo con este modelo, los estados de depresión surgen cuando los esquemas depresógenos se producen a partir de los significados proposicionales negativos (derivados del subsistema proposicional) y de los estados corporales negativos (derivados del subsistema de los estados corporales), y se mantienen porque existe un ciclo de retroalimentación negativa entre los diferentes subsistemas. Por otra parte, el Modelo de Simulación de Metáforas se

centra en explicar cómo se producen los síntomas somáticos de la depresión (p.ej., retardo psicomotor o postura encorvada) a partir de conceptos relacionados con la cognición encarnada, metáforas conceptuales e imaginería mental. Desde este modelo, estos síntomas se producen debido a que la desesperanza experimentada en la depresión es conceptualizada metafóricamente como incapacidad motora. Posteriormente, es simulada o recreada mentalmente, dando lugar a la experimentación de síntomas somáticos como la baja energía o el retardo psicomotor.

Por otra parte, la inclusión del cuerpo en terapia ha sido relegada a un papel muy secundario. Por ello, diversos autores están planteando la necesidad de determinar y sistematizar las manipulaciones corporales que podrían ser beneficiosas en la modificación de emociones y cogniciones en terapia (Folk et al., 2017). De hecho, estos autores han propuesto el abordaje de la cognición encarnada como un campo que tiene aplicaciones clínicas claras como una intervención sabia (o *wise intervention*), un tipo de intervención que Walton (2014) describió como una intervención breve y precisa, impulsada por la investigación y la teoría, en la que el principal objetivo es un cambio en un proceso psicológico específico que contribuye a algunos problemas.

En este sentido, sólo unos pocos estudios han analizado el efecto de la manipulación del cuerpo como estrategia coadyuvante en la terapia cognitivo-conductual. Específicamente, en el caso de las posturas corporales, sólo un estudio ha analizado el papel de la postura expansiva (*versus* contraída *versus* postura natural) como estrategia para mejorar la terapia de exposición en individuos diagnosticados con trastorno de ansiedad social (Davis et al., 2017), y los resultados apuntan a que la postura no tiene un efecto significativo sobre la severidad de los síntomas de ansiedad o los niveles hormonales de testosterona y cortisol. Sin embargo, es un estudio que deja varias preguntas abiertas que merecen ser respondidas (p.ej., ¿qué efecto tiene la postura en otros

resultados terapéuticos? ¿es beneficioso adoptar la postura durante la exposición? ¿enfatizar la manipulación de la espalda modificaría los resultados?).

Folk et al. (2017) remarcan que el uso de técnicas basadas en las teorías de la cognición encarnada se encuentra todavía en sus inicios, y se hace necesario su estudio para que se utilicen de forma sistemática junto a la terapia cognitivo-conductual u otras formas de terapia. Por ello, una meta propuesta por algunos autores consiste en incluir estrategias de "abajo-arriba" (p.ej., dirigidas a aspectos sensoriales) en las terapias que tradicionalmente se han caracterizado por usar estrategias de "arriba-abajo" (p.ej., dirigidas a expresar contenidos verbales de la experiencia) (Hauke, Lohr, y Pietrzak, 2017). De hecho, algunos estudios experimentales sugieren que la manipulación del cuerpo es un buen inductor de emociones, similar a otros procedimientos tradicionales de inducción emocional (p.ej., esuchar música, imaginación guiada, etc.) (Zhang, Yu, y Barrett, 2014), así como una estrategia de regulación emocional (Koole y Veenstra, 2015). De acuerdo con Koole (2009), el cuerpo es un sistema generador de emociones, que debe ser considerado en la regulación de emociones. Este autor afirma que algunas estrategias cognitivas no son más efectivas que las estraegias corporales (p.ej., respiración controlada o relajación muscular) a la hora de mantener un funcionamento emocional general adecuado. Posteriormente, Koole y Veenstra (2015) adoptan un enfoque de la regulación emocional en el que afirman que la regulación de las emociones no sólo ocurre dentro de la mente de los individuos. Así pues, estos autores señalan que es posible regular implícitamente las emociones a través de los cambios en la expresión corporal de las mismas (p.ej., a través de la postura).

En conclusión, las estrategias derivadas de las teorías de la cognición encarnada se están erigiendo como herramientas potenciales para ser utilizadas durante la terapia. Así, la evidencia empírica muestra que los procesos corporales, y concretamente las

posturas corporales, pueden actuar como activadoras de determinadas cogniciones, inductoras de emociones, y/o como estrategias de regulación emocional, que pueden ayudar a mejorar los resultados en la terapia. Sin embargo, se necesita más investigación para dilucidar los efectos que la manipulación del cuerpo puede tener como estrategia coadyuvante de terapias basadas en la evidencia.

2. Objetivos

La presente tesis doctoral tiene como objetivo fundamental analizar la influencia de adoptar una postura corporal expansiva y erguida (*versus* contraída y encorvada) sobre diversas respuestas cognitivas y emocionales. Así pues, los **objetivos generales** son:

1) Analizar el efecto de adoptar una postura corporal expansiva y erguida (*versus* contraída y encorvada) antes y durante la exposición a diversos estímulos ansiógenos (asociados a la ansiedad social y a los trastornos alimentarios) sobre procesos cognitivos y emocionales.

2) Investigar el efecto de adoptar una postura erguida (*versus* encorvada) en la modificación de dos mecanismos asociados al mantenimiento de la depresión (los sesgos cognitivos de interpretación y las dificultades en generar imágenes mentales), así como en las emociones relacionadas.

3) Explorar las posibles variables moderadores y mediadoras que nos permitan conocer mejor *para quién* y *cómo* se producen los efectos de la postura corporal en los procesos cognitivos y emocionales.

4) Clarificar las posibles implicaciones clínicas de la manipulación de la postura corporal como estrategia terapéutica para la promoción de cambios cognitivos y emocionales.

3. Metodología y resultados

Para lograr dichos objetivos, se realizaron tres estudios experimentales en el contexto de laboratorio, con un diseño aleatorizado inter-grupo, con dos condiciones experimentales: postura corporal expansiva y/o erguida (*versus* contraída y/o encorvada).

Los estudios 1 y 2 tienen como objetivo analizar el papel de una postura expansiva y erguida (*versus* contraída y encorvada) en la exposición a estímulos ansiógenos: una audiencia (en el caso del estudio 1, en individuos con miedo a hablar en público) y el propio cuerpo (en el caso del estudio 2, en individuos con insatisfacción corporal). Por otra parte, el estudio 3 tiene como objetivo analizar el papel de la postura erguida (*versus* encorvada) en los sesgos cognitivos de interpretación, las dificultades en imaginación positiva y las emociones asociadas a la depresión.

Por lo tanto, el primer y segundo estudio tienen como objetivo principal el análisis del efecto de la postura corporal como una estrategia para inducir emociones y pensamientos positivos que ayude a superar situaciones estresantes. Mientras que el tercer estudio tiene como objetivo principal investigar cómo una postura corporal no asociada con la depresión (*versus* asociada a la depresión), es decir, postura erguida (*versus* encorvada), influye en la disminución de los sesgos cognitivos asociados con el mantenimiento de la depresión. En los siguientes subapartados se detallan los objetivos específicos, metodología, resultados y conclusiones de cada estudio experimental.

Por último, cabe señalar que todos los estudios han sido aprobados por el Comité de Ética de la Universidad de Valencia, y todos los participantes han firmado un consentimiento informado antes de iniciar su participación en el estudio.

3.1. Estudio 1. Cómo la postura puede ayudar a dar un discurso oral: El papel de la expansión de la postura en una tarea de exposición.

El estudio 1 se detalla en el capítulo 2, y está fundamentado en el hecho de que las posturas expansivas y erguidas (*versus* contraídas y encorvadas) pueden tener un efecto beneficioso a nivel emocional y cognitivo en tareas estresantes (Cuddy et al., 2015; Nair et al., 2015), y en el hecho de que el papel de la postura corporal en el trastorno de ansiedad social ha sido escasamente estudiado (Gilboa-Schechtman y Shachar-Lavie, 2013).

El objetivo principal de este estudio consiste en analizar el efecto de una postura expansiva y erguida (*versus* contraída y encorvada) en el afecto, los pensamientos y las emociones negativas relacionadas con la exposición, antes y durante un discurso oral, en mujeres con miedo a hablar en público. Asimismo, los objetivos secundarios de este estudios consisten en: (1) analizar si el miedo a hablar en público es una variable que modera la relación entre la postura adoptada y el afecto, las cogniciones y las emociones negativas, tanto antes como durante el discurso oral; (2) explorar si adoptar una postura específica se considera un facilitador, un impedimento o irrelevante para realizar el discurso oral; y (3) examinar el efecto de la postura expansiva (*versus* contraída) en la evaluación que hacen las participantes de su actuación en el discurso, de forma anticipatoria y una vez realizada la tarea.

La muestra estuvo compuesta por 56 mujeres (M = 21.13, DT = 1.78 años) con una puntuación de moderada a alta en el nivel de miedo a hablar en público (que equivale a una puntuación ≥ 105 en el Cuestionario de Confianza para hablar en Público, Bados, 1986). Las participantes fueron asignadas al azar a la condición “postura expansiva” y “postura contraída”, en la que el grado de expansión de los brazos y piernas, así como la posición de la espalda fueron manipulados de acuerdo a los procedimientos de Carney et

al. (2010) y Michalak et al. (2014). Se encubrió el objetivo principal del estudio y se pidió a las participantes que mantuvieran la postura durante 2 minutos. Posteriormente, se les informó de que la tarea consistía en realizar un discurso oral delante de una audiencia que iba a ser grabada en vídeo. Para ello, se siguió el procedimiento de la Tarea del Discurso Improvisado (Beidel, Turner, Jacob, y Cooley, 1989). Las participantes prepararon el discurso durante 3 minutos y, seguidamente, realizan un discurso oral de 3 minutos de duración. Asimismo, se pedía a las participantes que mantuvieran dicha postura durante todo el procedimiento.

Se midió el afecto (Escala de Afecto Positivo y Negativo, PANAS, Sandin et al., 1999), los pensamientos (Escala de Autoverbalizaciones durante la Situación de Hablar en Público; SSPS, Rivero et al., 2010), y las emociones negativas (Escala de Emociones Negativas construida *ad-hoc*) en la línea base, antes y durante el discurso.

Se realizaron ANCOVAs de medidas repetidas, análisis de moderación, análisis de chi-cuadrado, y pruebas t de muestras independientes. Los resultados principales mostraron que las participantes en la condición expansiva (*versus* contraída) tenían, en promedio, un menor nivel de pensamientos negativos antes y durante el discurso oral, $F(1,53) = 4.61$, $p = .036$, $\eta^2_p = .08$. Asimismo, las participantes en la condición expansiva (*versus* contraída) con mayores niveles de miedo a hablar en público presentaban menores niveles de afecto negativo antes de dar el discurso, $F(1,51) = 4.04$, $p = .050$, 95% CI [0.001, 0.383]. No obstante, un gran porcentaje de participantes en ambas condiciones consideraron que adoptar una postura determinada era un impedimento para realizar el discurso oral (44.4% en la condición expansiva y 65.5% en la condición contraída).

Como se puede observar, los beneficios de adoptar una postura determinada en el afecto y los pensamientos sólo se observan antes de dar el discurso –y en el caso del afecto, sólo en aquellas mujeres con mayores niveles de miedo a hablar en público–. De

hecho, parece que adoptar una postura específica durante esta tarea ansiógena constituye un impedimento más que un facilitador. Por lo tanto, los resultados señalan la necesidad de realizar estudios que exploren el efecto de adoptar una postura expansiva (*versus* contraída) antes de la situación estresante y durante un breve período de tiempo. Así pues, se concluye que la adopción de una postura expansiva antes de la situación estresante podría actuar como un inductor de empoderamiento hacia uno mismo. Por el contrario, adoptar una postura expansiva durante la situación estresante podría experimentarse como un intento de ejercer poder sobre los otros. En este estudio se señala la necesidad de explorar los efectos en población clínica, de monitorizar la postura de forma objetiva con sensores posturales, así como de explorar los beneficios de manipular la postura antes de la exposición a estímulos ansiógenos. Así pues, se necesitan más estudios que permitan dilucidar si evitar una postura contraída o promover una postura expansiva presenta beneficios terapéuticos antes o durante la exposición a una situación ansiógena.

3.2. Estudio 2. Expande tu cuerpo cuando te mires al espejo: El papel de la postura en una tarea de exposición al espejo.

Este estudio experimental se detalla en el capítulo 3. De igual manera que el estudio 1, este estudio está fundamentado en el hecho de que las posturas expansivas y erguidas (*versus* contraídas y encorvadas) pueden tener un efecto beneficioso a nivel emocional y cognitivo en tareas estresantes (Cuddy et al., 2015; Nair et al., 2015). En el caso del tratamiento de los trastornos alimentarios, la exposición de espejo es uno de los principales componentes. De hecho, ha demostrado su eficacia para mejorar diversos resultados terapéuticos (p.ej., insatisfacción corporal) (Koskina, Campbell, y Schmidt, 2013; Trentowska, Svaldi, y Tuschen-Caffier, 2014). Sin embargo, hasta la fecha, no se

han realizado estudios que hayan analizado cuál es la postura corporal que debería adoptarse para maximizar la eficacia de esta técnica.

El objetivo principal de este estudio consistió en analizar el efecto de adoptar una postura expansiva y erguida (*versus* contraída y encorvada), antes de realizar una tarea de exposición al espejo, en las emociones y cogniciones relacionadas con el propio cuerpo, en mujeres que presentaban insatisfacción corporal. Los objetivos secundarios consistieron en: (1) explorar las emociones experimentadas con mayor frecuencia por las participantes durante la adopción de cada postura; (2) analizar si el índice de masa corporal es una variable que modera el efecto de la postura en el cambio en las emociones y cogniciones tras la exposición al propio cuerpo; y (3) explorar las variables que median la relación entre la postura y el cambio en las emociones y cogniciones tras la exposición al propio cuerpo.

La muestra estuvo compuesta por 68 mujeres, con una edad media de $M = 21.74$ ($DT = 3.12$), puntuaciones de leves a altas en insatisfacción corporal (≥ 81 en el Cuestionario de Forma Corporal, BSQ, Raich et al., 1996), y un índice de masa corporal medio de $M = 22.60$ ($DT = 2.66$). Los participantes fueron asignados aleatoriamente a la "condición expansiva" o a la "condición contraída", en el que se manipuló la apertura de los brazos y las piernas, y la posición de los hombros, cuello y espalda siguiendo el procedimiento de Cuddy et al. (2015). Asimismo, la postura fue monitorizada por un dispositivo electrónico con el objetivo de asegurar de manera objetiva que cada una de condiciones estaba manteniendo la postura asignada. Las participantes completaron varias medidas autoinformadas, antes de adoptar la postura y tras realizar la tarea de exposición al espejo, para evaluar las emociones positivas y negativas (cuestionario *ad-hoc*), los pensamientos negativos durante la tarea (Listado de Pensamientos, TCL, Cooper y Fairburn, 1992), la imagen corporal estado (Escala de Imagen corporal Estado, BISS, Cash, Fleming,

Alindogan, Steadman, y Whitehead, 2002), y la evaluación de las descripciones que las propias participantes otorgaban sobre su propio cuerpo (cuestionario *ad-hoc*).

Cabe mencionar que la postura fue adoptada durante 2 minutos, encubriéndose los efectos esperados de la postura, y que las participantes realizaron una tarea de exposición al espejo adaptada del procedimiento seguido por Luethcke, McDaniel, y Becker (2011) y Delinsky y Wilson (2006).

Se realizaron ANCOVAs unifactoriales, análisis de chi-cuadrado, pruebas t de muestras independientes, y análisis de moderación, de mediación y de mediación moderada. Los resultados principales fueron que las participantes que adoptaron una postura expansiva y erguida (*versus* contraída y encorvada) mostraron emociones positivas (autoconfianza y felicidad) más altas después de la tarea de exposición al espejo, $F(1,65) = 8.10$, $p = .006$, $\eta_p^2 = .11$. Este resultado converge con las diferencias encontradas en cuanto a las emociones experimentadas por cada condición durante la adopción de cada postura: un mayor porcentaje de participantes en la condición expansiva experimentó más autoconfianza que en la condición encorvada (80% *versus* 20%), y un mayor porcentaje de participantes en la condición encorvada experimentó más sumisión (100% *versus* 0%) e inseguridad (73.7% *versus* 26.3%) que en la condición expansiva. Asimismo, los análisis de mediación de tipo exploratorio mostraron que la adopción de una postura expansiva y erguida (*versus* contraída y encorvada) generó un mayor cambio en las emociones positivas, lo que condujo a puntuaciones más bajas en emociones negativas, *Efecto indirecto* = 0.37 (0.15), 95% IC [0.12, 0.73], y a puntuaciones mayores en imagen corporal estado, *Efecto indirecto* = -0.33 (0.14), 95% IC [-0.64, -0.09] y en evaluación positiva del propio cuerpo, *Efecto indirecto* = -0.21 (0.11), 95% IC [-0.51, -0.06], tras la tarea de exposición al espejo. Asimismo, los análisis de moderación mostraron que el índice de masa corporal moderaba la relación entre la postura y la

imagen corporal estado, $F(1,63) = 5.86$, $p = .018$, de forma que las participantes con menor índice de masa corporal se beneficiaban más de adoptar dicha postura. Sin embargo, los análisis de mediación moderada mostraron que este efecto desaparecía cuando se introducía en el mismo análisis el efecto indirecto de las emociones positivas, *Efecto indirecto* = 0.09 (0.07), 95% CI [-0.05, 0.23].

Por tanto, este estudio sugiere que la postura corporal expansiva es un inductor de emociones positivas, que ayuda a mejorar distintas respuestas cognitivas y emocionales que surgen cuando una persona con insatisfacción corporal es expuesta a su propio cuerpo. No obstante, es necesario investigar los efectos que dicha manipulación corporal tiene en muestras clínicas dentro de las terapias establecidas para los trastornos alimentarios, ya que todavía queda por dilucidar cómo, cuándo y para quién la postura expansiva es una estrategia coadyuvante en la técnica de exposición al propio cuerpo.

3.3. Estudio 3. El efecto de una postura erguida (versus encorvada) en los sesgos de interpretación, imaginación y emociones.

Este estudio experimental se desarrolla en el capítulo 4. Parte de la base de que, aun existiendo evidencia de los efectos positivos de adoptar una postura erguida (*versus* encorvada) en los procesos emocionales y cognitivos (p.ej., Michalak et al., 2014; Veenstra et al., 2016), hasta el momento no se ha analizado el efecto de dichas posturas sobre dos procesos clave asociados con el mantenimiento de la depresión señalados en el modelo de Holmes, Lang, y Deeprose (2009): los sesgos cognitivos de interpretación y las dificultades en la generación de las imágenes mentales.

El objetivo principal de este estudio consistió en analizar el efecto de una postura erguida (*versus* encorvada) en la interpretación cognitiva de la información ambigua y la viveza con la que se generan imágenes mentales positivas y negativas. Por otra parte, los

objetivos secundarios consistieron en: (1) analizar el efecto de adoptar una postura erguida (*versus* encorvada) en las respuestas emocionales (p.ej., tristeza, felicidad); (2) explorar la relación entre el porcentaje de tiempo adoptando una postura erguida (determinada por los sensores posturales colocados en la parte alta de la espalda) y el cambio en el sesgo de interpretación, la viveza en la imaginación y las emociones asociadas a la depresión; y (3) analizar si la sintomatología depresiva es una variable moderadora en el efecto que ejerce la postura sobre el sesgo de interpretación y la viveza en la imaginación.

La muestra estuvo compuesta por 54 participantes que presentaban un amplio rango de sintomatología depresiva de acuerdo con el Inventario de Depresión de Beck (BDI-II; Beck et al., 1996): ausencia de sintomatología depresiva, o sintomatología mínima, leve y moderada. La edad media de la muestra fue de 22.00 (*DT* = 2.84), el 64.8% fueron mujeres y la puntuación media en el BDI-II fue de 9.39 (*DT* = 7.60, rango entre 0 y 26). Los participantes fueron asignados aleatoriamente a la condición erguida (*n* = 26) o encorvada (*n* = 28). La postura fue manipulada siguiendo un procedimiento similar al descrito por Michalak et al. (2014).

Los participantes respondieron autoinformes, antes de adoptar la postura corporal y durante la adoptación de la misma, con el objetivo de evaluar el sesgo de interpretación (Test de Escenarios Ambiguos, AST-D-II, Rohrbacher y Reinecke, 2014), la viveza de la generación de imágenes mentales positivas y negativas (Tarea Prospectiva de Imágenes Mentales, PIT, Holmes et al., 2008) y las emociones relacionadas con la depresión (Escala de emociones construida *ad-hoc* y el Perfil de Estados de Ánimo, POMS, Andrade, Arce, de Francisco, Torrado, y Garrido, 2013). La posición de la espalda se controló mediante sensores posturales de tecnología inercial, que evaluaban la inclinación de la parte alta de la espalda.

Los resultados derivados de las ANCOVAs mostraron que los participantes que adoptaron una postura erguida (*versus* encorvada) realizaban interpretaciones más positivas de información ambigua, $F(1,51) = 4.82$, $p = .033$, $\eta_p^2 = .09$, mostraban emociones positivas más elevadas (felices y optimistas), $F(1,51) = 7.69$, $p = .008$, $\eta_p^2 = .13$, y mayor vigor, $F(1,51) = 6.07$, $p = .017$, $\eta_p^2 = .11$. Por otra parte, las correlaciones de Pearson mostraron que el porcentaje de tiempo en una postura corporal erguida se asociaba positivamente con el cambio en el sesgo cognitivo de interpretación ($r = .35$, $p = .014$) y la viveza con la que se generaban imágenes mentales positivas ($r = .44$, $p = .002$). Finalmente, los análisis de moderación mostraron que el nivel de sintomatología depresiva moderaba el efecto de la postura sobre el cambio en el sesgo de interpretación, $F(1,49) = 4.75$, $p = .034$, $R^2 = 0.012$. Es decir, a mayores niveles de sintomatología depresiva, mayor impacto tenía la manipulación de la postura en el modo de interpretar la información ambigua.

Este estudio indica que la postura corporal interactúa con mecanismos implicados en la etiología y mantenimiento de la depresión (sesgos cognitivos de interpretación y viveza en la imaginación), así como con las emociones relacionadas con la depresión (felicidad, optimismo y vigor). Este estudio tiene implicaciones teóricas y clínicas que deben continuar siendo exploradas con el objetivo de clarificar el papel de la postura corporal en la depresión.

4. Conclusiones y discusión

Tal y como se ha expuesto a lo largo de la tesis doctoral, los procesos corporales son fuentes valiosas de información que contribuyen a dar forma a nuestras emociones y pensamientos. Sin embargo, como también se ha señalado, los efectos derivados de la cognición encarnada apenas han sido estudiados en el campo de la psicopatología y la

psicología clínica. En consecuencia, las terapias actuales basadas en la evidencia no se han beneficiado todo lo posible del uso de las estrategias relacionadas con el cuerpo, que podrían ayudar a enriquecer y mejorar los resultados terapéuticos. Así pues, la presente tesis doctoral surgió de la necesidad de llenar dicho vacío en la literatura científica, con el objetivo último de investigar cómo las estrategias relacionadas con el cuerpo −y específicamente, las manipulaciones de la postura corporal− podrían ser utilizadas con fines terapéuticos.

Para ello, se han llevado a cabo tres estudios experimentales, con el objetivo común de analizar la influencia de adoptar una postura expansiva y erguida (*versus* contraída y encorvada) en diversas respuestas cognitivas y emocionales. En los siguientes párrafos se expondrán las conclusiones generales, respondiendo a cada uno de los objetivos generales de esta tesis:

(1) Efectos de la manipulación postural en la exposición a estímulos ansiógenos. Los resultados de ambos estudios sugieren que adoptar una postura expansiva y erguida (*versus* contraída y encorvada) influyó en la respuesta cognitiva y emocional de las mujeres, haciéndolas "sentir y pensar menos negativamente" antes de la exposición (en el caso de dar un discurso delante de una audiencia, en mujeres con miedo a hablar en público), y haciéndolas "sentir y pensar más positivamente" tras la exposición (en el caso de observar y describir su propio cuerpo, en mujeres con insatisfacción corporal). Los hallazgos derivados de los estudios 1 y 2 sugieren que la adopción de una postura expansiva y erguida podría usarse como coadyuvante de un procedimiento de inducción emocional (Zhang et al., 2014), es decir, como un procedimiento añadido que podría potenciar la evocación de una experiencia emocional y cognitiva requerida (p.ej., estar más preparada o empoderada para manejar la situación).

(2) Efectos de la postura en los mecanismos asociados con el mantenimiento de la depresión y emociones asociadas. La respuesta a este objetivo fue otorgada por el estudio 3, cuyos resultados mostraron que la postura corporal interactuaba con mecanismos implicados en el mantenimiento de la depresión (sesgos cognitivos de interpretación y dificultades en la generación de imágenes mentales), así como con emociones que tienden a estar disminuidas en la depresión. Así pues, aquellos participantes que adoptaron una postura erguida (*versus* encorvada) interpretaron la información ambigua de manera más positiva y experimentaron más emociones positivas. Como en el estudio 2, parece que la postura erguida permitió a los individuos "pensar y sentir de un modo más positivo". Tal y como propusieron Koole y Veenstra (2015), los resultados derivados del estudio 3 sugieren que la postura podría ser usada como una estrategia para regular las emociones de modo implícito, es decir, como un proceso dirigido a cambiar la cualidad, la intensidad o la duración de la respuesta emocional sin una intención explícita.

(3) Variables mediadoras y moderadoras de los efectos de la postura. Los resultados derivados de los análisis de mediación y moderación sugieren que los individuos que más se benefician de adoptar una postura expansiva y/o erguida (*versus* contraída y/o encorvada) son aquellos que presentan una sintomatología más elevada de miedo a hablar en público y una sintomatología depresiva mayor. En consecuencia, los resultados indican que los individuos que sufren sintomatología más elevada constituirían la "población diana", en la que debe alentarse la adoptación de una una postura expansiva y erguida, o la evitación de una postura contraída y encorvada. Respecto a los análisis de mediación, los resultados derivados del estudio 2 sugieren que el incremento de las emociones positivas (felicidad y autoconfianza) en aquellas mujeres que adoptaron una postura expansiva y erguida (*versus* contraída y encorvada) constituía el mecanismo por el cual

se generaba el cambio en variables relacionadas con la imagen corporal (p.ej., valoración del propio cuerpo).

De acuerdo con Körner et al. (2015), los cambios en los estados corporales derivados de haber dejado a las mujeres a solas con la postura, sin realizar ninguna otra tarea, podrían haber alterado directamente el estado emocional a través del mecanismo de "inducción directa de un estado determinado" −un mecanismo que parece ser universal y filogenéticamente adquirido−. En contraposición, el mecanismo responsable de no haberse encontrado resultados significativos en el estudio 1 pudo deberse a la puesta en funcionamiento del segundo mecanismo propuesto por Körner et al. (2015), llamado "efecto de facilitación modal", en el que se activaron conceptos abtractos idiosincráticos asociados a la postura expansiva (p.ej., conceptos de dominancia sobre otros en el caso de miedo a hablar en público).

(4) Posibles implicaciones de la postura corporal en terapia. Los tres estudios llevados a cabo nos permiten realizar un primer acercamiento en la delimitación de cómo se puede incluir el cuerpo en la terapia. Por un lado, los terapeutas podrían alentar a los pacientes a adoptar una postura expansiva y erguida antes de enfrentarse a una sesión de exposición durante un corto período de tiempo con el fin de "empoderarse". Sin embargo, como se ha discutido previamente en el estudio 1 y el estudio 2, es necesario evaluar si estos cambios afectivos y cognitivos en la exposición a estímulos ansiógenos tienen consecuencias negativas o positivas para la terapia a medio y largo plazo (p.ej., ¿la postura impide activar una respuesta negativa necesaria durante la exposición? ¿la postura aumenta la adherencia a la técnica de exposición? ¿la postura aumenta la autoconfianza para enfrentar una situación estresante?). Por otro lado, los terapeutas podrían llevar a cabo la corrección de la postura de sus pacientes durante las sesiones terapéuticas, especialmente cuando se está trabajando en la modificación de un sesgo cognitivo o las

emociones que pueden estar diminuidas en pacientes con depresión. Así pues, la postura podría actuar como una estrategia de regulación emocional y de facilitación del cambio de sesgos cognitivos. No obstante, se requiere una mayor evidencia empírica para poder realizar recomendaciones más sólidas en el contexto clínico.

La presente tesis doctoral tiene diversas fortalezas que otorgan solidez a los principales resultados. Estas fortalezas son: (1) realización de tres estudio aleatorizados experimentales que cumplen con los requisitos indispensables para alcanzar una adecuada validez interna; (2) investigación en un tema novedoso, en el que diversos autores están reclamando mayor evidencia empírica; (3) intento de dilucidar en qué momento y durante cuánto tiempo la postura debe ser adoptada, cómo se producen los efectos encarnados y para quién son más beneficiosos los efectos de la postura; y (4) desarrollo y uso de sensores de la postura corporal que permiten monitorizar la postura de manera objetiva.

No obstante, la presente tesis doctoral no está exenta de limitaciones. Las limitaciones que son comunes a todos los estudios son: (1) realización de los tres estudios en muestra no clínica y en estudiantes –y únicamente en mujeres en el caso de los estudios 1 y 2–; (2) realización de los tres estudios en un contexto de laboratorio, no clínico, lo que conlleva un aumento de la validez interna a cambio de una pérdida de validez externa o generalización de los resultados a población clínica (Roth y Fonagy, 2013); (3) carencia de una condición experimental control, en la que no se adoptara una postura específica; (4) ausencia de validación de los sensores corporales utilizados en el estudio 2 y 3; y (5) no medición de la respuesta fisiológica de los individuos, lo que ayudaría a dilucidar los mecanismos por los cuáles se producen efectos cognitivos y emocionales debidos a la postura corporal.

Como futuras direcciones, además de subsanar las limitaciones anteriores, sería recomendable: (1) replicar los hallazgos en diferentes muestras, o llevar a cabo pequeñas

modificaciones en los experimentos con el fin de desentrañar *qué postura* es adecuada *para qué trastorno mental*, *en qué momento* y para cambiar *qué resultado específico*; (2) investigar si es necesario manipular la expansión del cuerpo (como en el estudio 1 y 2), o es suficiente con la manipulación de la espalda, el cuello y los hombros de los individuos (como en el estudio 3) para lograr resultados específicos; (3) analizar los efectos emocionales y cognitivos de adoptar una postura desconociendo los efectos corporales de la postura *versus* conociendo los efectos de la postura corporal (p.ej., a partir de una breve psicoeducación); (4) explorar cómo la manipulación del cuerpo puede ser integrada en la vida diaria del paciente (p.ej., a través de aplicaciones móviles) y sus efectos a largo plazo; (5) trasladar los hallazgos encontrados en el laboratorio al contexto clínico (p.ej., a través de estudios de caso único); y (6) continuar investigando los mecanismos responsables de los efectos de la cognición encarnada.

En conclusión, la presente tesis doctoral proporciona evidencias de la influencia que ejerce la postura corporal en el procesamiento de la información a través de tres estudios experimentales, en muestras con sintomatología diversa (miedo a hablar en público, insatisfacción corporal y sintomatología depresiva). Los resultados señalan que adoptar una postura expansiva y erguida (*versus* una postura contraída y encorvada) tiene efectos beneficiosos sobre diversos procesos emocionales y cognitivos. No obstante, los efectos encarnados de la postura requieren seguir siendo investigados, ya que sólo la investigación nos ayudará a dilucidar cómo, cuándo, para quién y por qué adoptar una postura corporal específica podría ser beneficioso en el contexto terapéutico, como una estrategia coadyuvante de las actuales terapias basadas en la evidencia.

5. Referencias

Anderson, J. R. (1983). *The architecture of cognition.* Cambridge, MA: Harvard University Press.

Andrade, E., Arce, C., De Francisco, C., Torrado, J., y Garrido, J. (2013). Versión breve en español del cuestionario POMS para deportistas adultos y población general. *Revista de psicología del deporte*, *22*(1), 59-102.

Bados, A. (1986). *Análisis de componentes de un tratamiento cognitivo-somático-conductual del miedo a hablar en público*. Tesis doctoral no publicada, University of Barcelona, Barcelona.

Barnard, P. J., y Teasdale, J. D. (1991). Interacting cognitive subsystems: A systemic approach to cognitive-affective interaction and change. *Cognition & Emotion*, *5*(1), 1-39. doi: 10.1080/02699939108411021

Barsalou, L. W. (1999). Perceptions of perceptual symbols. *Behavioral and brain sciences*, *22*(4), 637-660. doi: 10.1017/S0140525X99532147

Barsalou, L. W. (2008). Grounded Cognition. *Annual Review of Psychology*, *59*(1), 617–645. doi: 10.1146/annurev.psych.59.103006.093639

Barsalou, L. W. (2015). Situated Conceptualization : Theory and Application. En Y. Coello y M. H. Fischer (Eds.), *Foundations of embodied cognition*. East Sussex, UK: Psychology Press.

Beck, A. T., Steer, R. A., y Brown, G. K. (1996). *Beck Depression Inventory Manual.* San Antonio, TX: The Psychological Corporation.

Beidel, D. C., Turner, S. M., Jacob, R. G., y Cooley, M. R. (1989). Assessment of social phobia: Reliability of an impromptu speech task. *Journal of anxiety disorders*, *3*(3), 149-158. doi: 10.1016/0887-6185(89)90009-1

Briñol, P., Petty, R. E., y Wagner, B. (2009). Body posture effects on self-evaluation: A self-validation approach. *European Journal of Social Psychology*, *39*(6), 1053-1064. doi: 10.1002/ejsp.607

Cacioppo, J. T., Priester, J. R., y Berntson, G. G. (1993). Rudimentary determinants of attitudes: II. Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology*, *65*(1), 5–17. doi: 10.1037/0022-3514.65.1.5

Carney, D. R., Cuddy, A. J. C., y Yap, A. J. (2010). Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science*, *21*(10), 1363–1368. doi: 10.1177/0956797610383437

Carney, D. R., Cuddy, A. J. C., y Yap, A. J. (2015). Review and Summary of Research on the Embodied Effects of Expansive (vs. Contractive) Nonverbal Displays. *Psychological Science*, *26*(5), 657–663. doi: 10.1177/0956797614566855

Cash, T.F., Fleming, E.C., Alindogan, J., Steadman, L., y Whitehead, A. (2002). Beyond body image as a trait: The development and validation of the Body Image States Scale. *Eating Disorders: The Journal of Treatment & Prevention*, *10*, 103–113. doi: 10.1080/10640260290081678

Cooper, M. J., y Fairburn, C. G. (1992). Thoughts about eating, weight and shape in anorexia nervosa and bulimia nervosa. *Behaviour Research and Therapy*, *30*(5), 501–511. doi: 10.1016/0005-7967(92)90034-E

Cuddy, A. J. C., Schultz, S. J., y Fosse, N. E. (2018). P-Curving a More Comprehensive Body of Research on Postural Feedback Reveals Clear Evidential Value For Power-Posing Effects: Reply to Simmons and Simonsohn (2017). *Psychological Science*, *29*(4), 656-666. doi: 10.1177/0956797617746749

Cuddy, A. J. C., Wilmuth, C. A., Yap, A. J., y Carney, D. R. (2015). Preparatory power posing affects nonverbal presence and job interview performance. *Journal of Applied Psychology*, *100*(4), 1286–1295. doi: 10.1037/a0038543

Davis, M. L., Papini, S., Rosenfield, D., Roelofs, K., Kolb, S., Powers, M. B., y Smits, J. A. J. (2017). A randomized controlled study of power posing before public speaking exposure for social anxiety disorder: No evidence for augmentative effects. *Journal of Anxiety Disorders*, *52*(Dec), 1–7. doi: 10.1016/j.janxdis.2017.09.004

Delinsky, S. S., y Wilson, G. T. (2006). Mirror exposure for the treatment of body image disturbance. *International Journal of Eating Disorders*, *39*(2), 108–116. doi:10.1002/eat.20207

Folk, J. B., Disabato, D. J., Goodman, F. R., Carter, S. P., DiMauro, J. C., y Riskind, J. H. (2017). Wise additions bridge the gap between social psychology and clinical practice: Cognitive-behavioral therapy as an exemplar. *Journal of Psychotherapy Integration*, *27*(3), 407–423. doi: 10.1037/int0000038

Förster, J. (2003). The influence of approach and avoidance motor actions on food intake. *European Journal of Social Psychology*, *33*(3), 339–350. doi: 10.1002/ejsp.150

Gilboa-Schechtman, E., y Shachar-Lavie, I. (2013). More than a face: a unified theoretical perspective on nonverbal social cue processing in social anxiety. *Frontiers in human neuroscience, 7*, 904. doi: 10.3389/fnhum.2013.00904

Glenberg, A. M. (2010). Embodiment as a unifying perspective for psychology. *European Journal of Social Psychology*, *39*(7), 1135–1141. doi: 10.1002/ejsp.670

Glenberg, A. M., Witt, J. K., y Metcalfe, J. (2013). From the Revolution to Embodiment: 25 Years of Cognitive Psychology. *Perspectives on Psychological Science*, *8*(5), 573–585. doi: 10.1177/1745691613498098

Gronau, Q. F., Van Erp, S., Heck, D. W., Cesario, J., Jonas, K. J., y Wagenmakers, E.-J. (2017). A Bayesian model-averaged meta-analysis of the power pose effect with informed and default priors: the case of felt power. *Comprehensive Results in Social Psychology*, *2*(1), 123–138. doi: 10.1080/23743603.2017.1326760

Hauke, G., Lohr, C., y Pietrzak, T. (2017). Moving the mind: Embodied cognition in Cognitive Behavioural Therapy (CBT). *European Psychotherapy*, 154–178.

Havas, D. A., Glenberg, A. M., Gutowski, K. A., Lucarelli, M. J., y Davidson, R. J. (2010). Cosmetic use of botulinum toxin-a affects processing of emotional language. *Psychological Science*, *21*(7), 895–900. doi: 10.1177/0956797610374742

Holmes, E. A., Lang, T. J., y Deeprose, C. (2009). Mental imagery and emotion in treatment across disorders: Using the example of depression. *Cognitive Behaviour Therapy*, *38*(S1), 21-28. doi: 10.1080/16506070902980729

Holmes, E. A., Lang, T. J., Moulds, M. L., y Steele, A. M. (2008). Prospective and positive mental imagery deficits in dysphoria. *Behaviour research and therapy*, *46*(8), 976-981. doi: 10.1016/j.brat.2008.04.009

Hurley, S. (2001). Perception and Action: Alternative Views. *Cognition*, *129*(1), 3–40. doi: 10.1111/1467-8349.00078

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition and Emotion*, *23*(1), 4–41. doi: 10.1080/02699930802619031

Koole, S. L., y Veenstra, L. (2015). Does Emotion Regulation Occur Only Inside People's Heads? Toward a Situated Cognition Analysis of Emotion-Regulatory Dynamics. *Psychological Inquiry*, *26*(1), 61–68. doi: 10.1080/1047840X.2015.964657

Körner, A., Topolinski, S., y Strack, F. (2015). Routes to embodiment. *Frontiers in Psychology*, *6*(940), 1–10. doi: 10.3389/fpsyg.2015.00940

Koskina, A., Campbell, I. C., y Schmidt, U. (2013). Exposure therapy in eating disorders revisited. *Neuroscience & Biobehavioral Reviews*, *37*(2), 193–208. doi: 10.1016/j.neubiorev.2012.11.010

Lakoff, G., y Johnson, M. (1980). *Metaphors we live by.* Chicago, IL: University of Chicago Press.

Lakoff, G., y Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought.* New York: Basic Books.

Lang, P. J. (1979). A Bio-Informational Theory of Emotional Imagery. *Psychophysiology*, *16*(6), 495-512. doi: 10.1111/j.1469-8986.1979.tb01511.x

Lindeman, L. M., y Abramson, L. Y. (2008). The Mental Simulation of Motor Incapacity in Depression. *Journal of Cognitive Psychotherapy*, *22*(3), 228–249. doi: 10.1891/0889-8391.22.3.228

Luethcke, C. A., McDaniel, L., y Becker, C. B. (2011). A comparison of mindfulness, nonjudgmental, and cognitive dissonance-based approaches to mirror exposure. *Body Image*, *8*(3), 251–258. doi:10.1016/j.bodyim.2011.03.006

Michalak, J., Mischnat, J., y Teismann, T. (2014). Sitting posture makes a difference-embodiment effects on depressive memory bias. *Clinical Psychology and Psychotherapy*, *21*(6), 519–524. doi: 10.1002/cpp.1890

Michalak, J., Rohde, K., y Troje, N. F. (2015). How we walk affects what we remember: Gait modifications through biofeedback change negative affective memory bias. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 121–125. doi: 10.1016/j.jbtep.2014.09.004

Michalak, J., Troje, N. F., Fischer, J., Vollmar, P., Heidenreich, T., y Schulte, D. (2009). Embodiment of sadness and depression-gait patterns associated with dysphoric mood. *Psychosomatic Medicine*, *71*(5), 580–587. doi: 10.1097/PSY.0b013e3181a2515c

Nair, S., Sagar, M., Sollers, J., Consedine, N., y Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology*, *34*(6), 632–641. doi: 10.1037/hea0000146

Newel, A., y Simon, H. A. (1976). Computer Science as empirical Inquiry: Symbols and Search. *Communications of the ACM*, *19*(3), 113–126. doi: 10.1145/360018.360022

Niedenthal, P. M. (2007). Embodying emotion. *Science*, *316*(5827), 1002–1005. doi: 10.1126/science.1136930

Niedenthal, P. M., Winkielman, P., Mondillon, L., y Vermeulen, N. (2009). Embodiment of Emotion Concepts. *Journal of Personality and Social Psychology*, *96*(6), 1120–1136. doi: 10.1037/a0015574

Peper, E., y Lin, I. M. (2012). Increase or Decrease Depression: How Body Postures Influence Your Energy Level. *Biofeedback*, *40*(3), 125–130. doi: 10.5298/1081-

5937-40.3.01

Price, T. F., Peterson, C. K., y Harmon-Jones, E. (2012). The emotive neuroscience of embodiment. *Motivation and Emotion*, *36*(1), 27–37. doi: 10.1007/s11031-011-9258-1

Rahona, J. J., Ruiz Fernández, S., Rolke, B., Vázquez, C., y Hervás, G. (2014). Overt head movements moderate the effect of depressive symptoms on mood regulation. *Cognition and Emotion*, *28*(7), 1328–1337. doi: 10.1080/02699931.2014.881323

Raich, R.Mª, Mora, M., Soler, A., Ávila, C., Clos, I., y Zapater, I. (1996). Adaptación de un instrumento de evaluación de la insatisfacción corporal. *Clínica y Salud, 7*(1), 51–66.

Rivero, R., Garcia-Lopez, L., y Hofmann, S. G. (2010). The Spanish Version of the Self-Statements During Public Speaking Scale. *European Journal of Psychological Assessment, 26,* 129-135. doi: 10.1027/1015-5759/a000018.

Rohrbacher, H., y Reinecke, A. (2014). Measuring change in depression-related interpretation bias: development and validation of a parallel ambiguous scenarios test. *Cognitive behaviour therapy*, *43*(3), 239-250. doi: 10.1080/16506073.2014.919605

Roth, A., y Fonagy, P. (2013). *What works for whom?: a critical review of psychotherapy research.* New York, NY: Guilford Publications.

Sandín, B., Chorot, P., Lostao, L., Joiner, T. E., Santed, M. A., y Valiente, R. M. (1999). Escalas PANAS de afecto positivo y negativo: validación factorial y convergencia transcultural. *Psicothema*, *11*(1), 37-51.

Smith, E.R., y Semin, G.R. (2004). Socially situated cognition: Cognition in its social context.. *Advances in experimental social psychology, 36,* 53-117.

Teasdale, J. D., y Barnard, P. J. (1993). *Affect, cognition and change: Remodelling depressive thought*. Hove, East Sussex: Psychology Press.

Trentowska, M., Svaldi, J., y Tuschen-Caffier, B. (2014). Efficacy of body exposure as treatment component for patients with eating disorders. *Journal of Behavior Therapy and Experimental Psychiatry*, *45*(1), 178–185. doi: 10.1016/j.jbtep.2013.09.010

Tsai, H. Y., Peper, E., y Lin, I. M. (2016). EEG patterns under positive/negative body postures and emotion recall tasks. *NeuroRegulation*, *3*(1), 23–27. doi: 10.15540/nr.3.1.23

Veenstra, L., Schneider, I. K., y Koole, S. L. (2016). Embodied mood regulation: the impact of body posture on mood recovery, negative thoughts, and mood-congruent recall. *Cognition and Emotion*, *31*(7), 1361–1376. doi: 10.1080/02699931.2016.1225003

Walton, G. M. (2014). The New Science of Wise Psychological Interventions. *Current Directions in Psychological Science*, *23*(1), 73–82. doi: 10.1177/0963721413512856

Wells, G. L., y Petty, R. E. (1980). The effects of over head movements on persuasion: Compatibility and incompatibility of responses. *Basic and Applied Social Psychology, 1*(3), 219-230. doi: 10.1207/s15324834basp0103_2

Wiers, R. W., Eberl, C., Rinck, M., Becker, E. S., & Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science*, *22*(4), 490–497. doi: 10.1177/0956797611400615

Wilkes, C., Kydd, R., Sagar, M., y Broadbent, E. (2017). Upright posture improves affect and fatigue in people with depressive symptoms. *Journal of Behavior Therapy and Experimental Psychiatry*, *54*, 143–149. doi: 10.1016/j.jbtep.2016.07.015

Winkielman, P., Niedenthal, P., Wielgosz, J., Eelen, J., y Kavanagh, L.C. (2015). Embodiment of cognition and emotion. En M. Mikulincer, P.R. Shaver, E. Borgida, J.A. Bargh (Eds.), *APA handbooks in psychology. APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 151-175). Washington, DC, US: American Psychological Association.

Wollmer, M. A., De Boer, C., Kalak, N., Beck, J., Götz, T., Schmidt, T., …y Kruger, T. H. C. (2012). Facing depression with botulinum toxin: A randomized controlled trial. *Journal of Psychiatric Research*, *46*(5), 574–581. doi: 10.1016/j.jpsychires.2012.01.027

Zhang, X., Yu, H. W., y Barrett, L. F. (2014). How does this make you feel? A comparison of four affect induction procedures. *Frontiers in Psychology*, *5*(689), 1–10. doi: 10.3389/fpsyg.2014.00689

SUMMARY IN VALENCIAN/ RESUM EN VALENCIÀ

1. Introducció

1.1. Cognició i emoció encarnada

El concepte de cognició encarnada podria definir-se com *"*un efecte on el cos, el seu estat sensoriomotor, la seua morfologia, o la seua representació mental juga un paper instrumental en el processament de la informació*"* (Körner, Topolinski, i Strack, 2015, p.1). Aquesta definició fenomenològica inclou un principi fonamental de la cognició encarnada o emoció encarnada recollit en diverses definicions: el processament de la informació és una activitat que no es troba separada del cos, ja que tant els processos cognitius com els emocionals estan fortament influenciats pel cos, incloent-n'hi la morfologia, els sistemes sensorials i els sistemes motors (p. ex., Glenberg, 2010; Glenberg, Witt, i Metcalfe, 2013; Winkielman, Niedenthal, Wielgosz, Eelen, i Kavanagh, 2015). Per tant, els conceptes de cognició encarnada o emoció encarnada suggereixen que les cognicions i les emocions estan encarnades i, conseqüentment, el processament d'informació no constitueix una activitat separada dels processos corporals com la propiocepció o els moviments corporals.

El cos i els seus processos implicats han rebut poca atenció des de les teories del processament cognitiu que han dominat les darreres dècades. Així doncs, les teories cognitives tradicionals del processament de la informació desenvolupades entre la dècada dels seixanta i vuitanta aproximadament (p. ex., Anderson, 1983; Lang, 1979; Newel i Simon, 1976) consideraven que la ment era un processador abstracte d'informació, on el paper del cos i la informació proporcionada per aquest eren totalment irrellevants. Aquestes teories consideren que després d'experimentar un estat emocional (p. ex., felicitat), la representació cognitiva de l'emoció es "desencarna" en la nostra ment, la informació sensorial és eliminada (p. ex., l'experiència de sentir-se feliç) i és representada en la nostra ment com una proposició (p. ex., "hem sent feliç") que és emmagatzemada

en la nostra memòria en forma de símbols abstractes. Així doncs, el "model de *sandwich*" és el que impera en aquestes teories (Hurley, 2001), ja que es considera que la cognició es troba en un mòdul, que és independent dels processos perceptius o motors, és a dir, del cos. Conseqüentment, la ment és considerada com una espècie de *sandwich*, on la cognició se situa entre la percepció i les accions. Per tant, el cos forma part d'un mòdul que no pot interactuar amb la cognició.

En contraposició, en els últims anys s'ha produït un canvi radical en la forma d'entendre el processament de la informació. L'evidència empírica assenyala que el cos exerceix una gran influència en la conformació dels nostres pensaments i emocions. Aquestes troballes s'emmarquen en les teories de la cognició encarnada (p. ex., Barsalou, 2008; Niedenthal, 2007), en les quals el supòsit bàsic és que el processament de la informació es troba influenciat, associat, i de vegades depenent, de recursos perceptius, somatosensorials i motors (Winkielman et al., 2015). Per tant, aquestes teories assumeixen que la cognició o el processament de la informació pot dependre d'estats corporals i accions físiques. Així doncs, els estats cognitius poden influenciar els estats corporals associats, i al revés (Barsalou, 2015). Per tant, des d'aquestes teories se suggereix que el cos −que tinguem cara, cap, braços, tors o cames− influeix en les nostres experiències sensorials i motores, contribuint així en la construcció de les bases del processament d'informació, tant a nivell afectiu (p. ex., produint emocions determinades) com a nivell cognitiu (p. ex., produint actituds, pensaments o judicis específics).

D'altra banda, existeixen altres teories que s'engloben sota el nom de *Grounded Cognition*, com la teoria de Sistemes de Símbols Perceptius (*Perceptual Symbol Systems*, Barsalou, 1999) o l'Acció/Cognició Situada (*Situated Action/Cognition*, Smith i Semin, 2004), que amplien l'enfocament de les teories de cognició encarnada. Aquestes teories consideren que la cognició pot estar influenciada per estats corporals, però que, en

ocasions, la cognició pot generar-se independentment dels estats corporals a partir d'altres processos (p. ex., a partir de simulacions mentals d'estats corporals previs). Així mateix, una altra teoria que s'engloba dins de l'enfocament de *Grounded Cognition*, és la teoria Lingüística Cognitiva de Lakoff i Johnson (1980; 1999), que assenyala que part del nostre llenguatge −els conceptes abstractes− s'associen en forma de metàfores a un coneixement "encarnat" (p. ex., el pensament abstracte sobre moralitat s'associa a l'experiència de neteja física). Així doncs, l'ús de metàfores indica la manera en el qual les persones representen i pensen sobre els conceptes abstractes, i aquesta manera de representar el pensament és el resultat de la interacció entre el cos i el món.

Cal esmentar que en aquesta tesi doctoral s'assumirà una perspectiva no radical de les teories de cognició encarnada. Així doncs, es considera que el cos proporciona informació valuosa i sofisticada en la cognició, que és usada en algunes ocasions, però no sempre. És a dir, els estats corporals representen un factor més que pot contribuir al processament de la informació, però no l'únic. Glenberg et al. (2013) afirma que considerar que el cos està present quan sentim, pensem o actuem, ens portarà a un marc conceptual de la psicologia més unificat, útil i comprensiu. De fet, Glenberg (2010) suggereix que els principis de cognició encarnada es poden aplicar a tots els camps de la psicologia, incloent la psicologia clínica.

Finalment, cal ressaltar l'enfocament parsimoniós que proposen Körner et al. (2015) per dilucidar els mecanismes que podrien estar a la base dels efectes dels estats o processos corporals en el processament de la informació. Així doncs, aquests autors suggereixen tres mecanismes automàtics amb diferents propietats i conseqüències, que poden actuar per separat o conjuntament, i que permeten explicar tots els efectes psicològics "encarnats" que es troben en els estudis emmarcats dins de les teories de cognició encarnada:

(1) Mecanisme 1: Inducció directa d'un estat determinat. Els estats corporals alteren directament l'estat mental, els sentiments o el processament de la informació (p. ex., els estats afectius o no afectius) dels individus, i no estan mediats per altres mecanismes cognitius, com les atribucions o inferències conscients (p. ex., somriure indueix un estat de felicitat).

(2) Mecanisme 2: Efecte de facilitació modal. Els estats corporals alteren la disponibilitat d'informació o contingut específic en la ment. Així doncs, la manipulació del cos augmenta l'accessibilitat a conceptes associats (p. ex., somriure activa conceptes relacionats amb la diversió o la felicitat), ja que es pressuposa que les representacions mentals dels conceptes contenen aspectes específics de tipus motor i sensorial.

(3) Mecanisme 3: Simulació sensoriomotora. Els estats corporals poden complementar-se amb simulacions mentals automàtiques concurrents que afecten el processament de la informació, el judici i el comportament (p. ex., somriure o impedir somriure, junt a la simulació mental d'un somriure que es produeix quan s'està avaluant un estímul divertit, pot facilitar o impedir l'avaluació d'aquest estímul com a divertit). La simulació automàtica és una reactivació parcial de l'acció o la sensació experimentada que utilitza les mateixes regions neuronals que quan aquestes són experimentades realment. Per això, la simulació pot tenir lloc quan l'estat físic simulat, les sensacions o les accions estan absents i no estan sent experimentades realment.

1.2. Estudis emmarcats en les teories de la cognició encarnada

Una revisió duta a terme per Price, Peterson, i Harmon-Jones (2012) recolza la relació bidireccional entre els processos corporals i els processos emocionals i cognitius. Així doncs, diversos estudis experimentals proporcionen suport empíric a aquesta relació bidireccional a través de la manipulació de l'expressió facial (p. ex., Havas, Glenberg,

Gutowski, Lucarelli, i Davidson, 2010; Niedenthal, Winkielman, Mondillon, i Vermeulen, 2009; Wollmer et al., 2012), els moviments del braç (p. ex., Cacioppo, Priester, i Berntson, 1993; Föster, 2003; Wiers, Eberl, Rinck, Becker, i Lindenmeyer, 2011), els moviments del cap (p. ex., Wells i Petty, 1980; Rahona, Ruiz Fernández, Rolke, Vázquez, i Hervás, 2014), la forma de caminar (p. ex., Michalak et al., 2009; Michalak, Rohde, i Troje, 2015; Peper i Lin, 2012) i la postura corporal (p. ex., Cuddy, Schultz, i Fosse, 2018).

A causa que el focus de la present tesi doctoral està centrat en l'anàlisi dels efectes psicològics de la postura corporal, a continuació, s'expliquen amb més detall els estudis més rellevants quant a l'efecte de postures amb l'esquena dreta i expansiva (*versus* postures encorbades i contretes). No obstant això, per facilitar la comprensió d'aquests estudis, s'aclariran les diferències entre ells i s'explicaran les seues característiques generals. En primer lloc, cal assenyalar les diferències que existeixen entre els estudis que manipulen la postura amb l'esquena dreta (*versus* encorbada) d'aquells que manipulen la postura expansiva (*versus* contreta). Els estudis experimentals que manipulen la postura amb l'esquena dreta (*versus* encorbada) posen l'accent en que els participants mantinguen l'esquena i el cos dret, eleven el mentó, i mantinguen els muscles cap a enrere (p. ex., Michalak, Mischnat, i Teismann, 2014). Per contra, els estudis que manipulen la postura expansiva (*versus* contreta) posen l'accent en l'amplitud de l'espai ocupat per les extremitats del cos o en l'obertura del cos (p. ex., Carney, Cuddy, i Yap, 2010). En segon lloc, cal ressaltar que no hi ha acord entre els estudis pel que fa a la durada d'adopció de la postura (p. ex., pot variar d'1 minut a 30 minuts); el moment concret en el qual s'adopta la postura (p. ex., si s'adopta abans i/o durant la tasca experimental); si la postura s'adopta mentre els participants estan asseguts o dempeus; o si s'explica una *cover story* (o història que serveix com a "tapadora") per encobrir als participants els efectes esperats de la

postura (Carney, Cuddy, i Yap, 2015). No obstant això, el procediment més comú és que els participants adopten la postura corporal durant un curt període de temps, seguint les instruccions verbals de l'investigador, i sense tenir coneixements dels efectes esperats d'adoptar una postura corporal específica. A continuació, s'hi presenten els estudis de postura corporal més rellevants per justificar els estudis experimentals realitzats en la investigació.

Una àmplia evidència empírica suggereix que adoptar una postura amb l'esquena dreta i/o expansiva (*versus* encorbada i/o contreta) té efectes positius en processos emocionals, cognitius, comportamentals i fisiològics. Així doncs, les postures expansives i amb l'esquena dreta s'han relacionat amb una major sensació de poder, una major tendència al risc en una tasca experimental, i canvis hormonals associats amb un major domini o control de la situació (testosterona) i un menor estrès (cortisol) (Carney et al., 2010); un millor rendiment general durant una entrevista de treball –simulada, però estressant–, a causa d'un millor comportament no verbal (major autoconfiança) (Cuddy, Wilmuth, Yap, i Carney, 2015); una major confiança en els atributs personals positius generats pels propis individus (Briñol, Petty, i Wagner, 2009); i també amb una major autoestima, major activació fisiològica, estat d'ànim més positiu, una menor emoció de por, i més paraules verbalitzades (especialment positives) durant un discurs oral altament estressant (Nair, Sagar, Sollers, Consedine, i Broadbent, 2015). A més, una recent metaanàlisi bayesiana d'estudis preenregistrats ha demostrat que existeix una relació significativa entre l'adopció d'una postura expansiva i l'increment de la sensació de poder autoinformat (Gronau et al., 2017). En la mateixa línia, una revisió sistemàtica d'estudis relacionats amb els efectes de la postura corporal utilitzant anàlisi *p-curve,* van revelar un fort suport empíric per als efectes de les postures corporals expansives i amb l'esquena

dreta en l'increment de la sensació de poder, així com en altres emocions, afecte i autoavaluacions (Cuddy et al., 2018).

De manera similar, les postures amb l'esquena dreta (*versus* encorbades) s'han relacionat amb canvis en els biaixos de processament de la memòria, que poden estar a la base del desenvolupament i manteniment d'alguns trastorns mentals. En un estudi realitzat per Michalak et al. (2014) es va demanar als participants diagnosticats amb trastorn depressiu major que crearen una escena visual relacionada amb paraules positives (p. ex., "gaudiment") i negatives (p. ex., "esgotament"). Per això, havien d'imaginar-se a ells mateixos en aquesta escena (p. ex., una escena en la qual se sentien esgotats) mentre mantenien una postura amb l'esquena dreta o encorbada. Després d'una tasca de distracció, s'hi va observar que els participants asseguts en una postura encorbada van recordar més paraules negatives, mentre que els participants asseguts en una postura amb l'esquena dreta van mostrar un record equivalent de paraules positives i negatives. De manera similar, altres estudis amb mostres no clíniques han mostrat resultats similars. Per exemple, Wilson i Peper (2004) van avaluar si era més fàcil generar records d'esdeveniments passats positius i negatius en una postura corporal amb l'esquena dreta o encorbada, trobant que els esdeveniments passats positius eren més fàcils de recordar en la postura amb l'esquena dreta. Posteriorment, Tsai, Peper, i Lin (2016) van registrar els patrons electroencefalogràfics d'individus durant el record d'esdeveniments positius i negatius mentre mantenien una postura amb l'esquena dreta o encorbada. S'hi va trobar que el record d'esdeveniments positius requeria més esforç o activació cortical en una postura encorbada (en comparació d'una postura amb l'esquena dreta).

Finalment, cal esmentar que la postura adoptada sembla tindre diferents efectes sobre els símptomes emocionals que poden sorgir en els trastorns emocionals. Wilkes, Kydd, Sagar, i Broadbent (2017) van trobar que la postura amb l'esquena dreta (en

comparació a la postura natural adoptada per la persona) pot contribuir a l'augment de l'afecte positiu, la reducció de fatiga i la disminució de l'autofocalització excessiva en un discurs oral en persones amb depressió de lleu a moderada. En la mateixa línia, Veenstra, Schneider i Koole (2016) van concloure que la postura pot exercir un paper important en la recuperació d'un estat d'ànim negatiu. Els participants que van adoptar una postura encorbada (*versus* postura amb l'esquena dreta) es van recuperar en menor mesura d'una inducció d'estat d'ànim negatiu. A més, aquesta troballa s'hi va mantenir independentment de si els participants intentaven regular les seues emocions a través de una estratègia de reavaluació cognitiva.

En resum, es pot concloure que existeix una forta evidència empírica respecte als efectes positius de les postures expansives i/o amb l'esquena dreta (*versus* contretes i/o encorbades) en els processos cognitius, emocionals i conductuals. No obstant això, fins avui, existeix escassa evidència sobre com un terapeuta pot usar la postura corporal durant la teràpia. Per exemple, encara es desconeix què postura corporal és l'adequada per canviar un resultat específic, en quin moment és recomanable usar-la o durant quant temps deu una persona mantenir la postura.

1.3. El cos en psicologia clínica

La inclusió del cos en models psicopatològics explicatius dels trastorns mentals ha sigut quasi inexistent. En aquesta tesi es presenten dos models que han ressaltat la importància dels processos corporals en el desenvolupament i manteniment de la simptomatologia dels trastorns mentals –principalment dirigits a explicar la depressió–. Aquests models són el model de Subsistemes Cognitius Interactius (*Interacting Cognitive Subsystems*) (Barnard i Teasdale, 1991; Teasdale i Barnard, 1993) i el Model de Simulació de Metàfores (*Metaphor Simulation Model*) (Lindeman i Abramson, 2008).

Així doncs, el model de Subsistemes Cognitius Interactius és un model teòric integral de l'organització i de les funcions dels diferents recursos subjacents a la cognició. Segons aquest model, existeixen diversos subsistemes cognitius especialitzats en el maneig d'informació de diferents tipus. Un d'ells és el "subsistema implicacional", que està directament relacionat amb l'emoció, i codifica models esquemàtics que processen nivells de significats implícits, genèrics i integrals (p. ex., visió global negativa del jo o del futur). Aquest sistema integra informació d'altres dos subsistemes: el "subsistema proposicional", que codifica significats específics, explícits, fàctics o conceptuals (p. ex., si un ha comès errors recentment); i el "subsistema dels estats corporals", que codifica les entrades sensorials del gust, l'olfacte, tacte, dolor i propiocepció (p. ex., si la postura és amb l'esquena dreta o encorbada, o si s'està frunzint el front o somrient). D'acord amb aquest model, els estats de depressió sorgeixen quan els esquemes depresògens es produeixen a partir dels significats proposicionals negatius (derivats del subsistema proposicional) i dels estats corporals negatius (derivats del subsistema dels estats corporals), i es mantenen perquè existeix un cicle de retroalimentació negativa entre els diferents subsistemes. D'altra banda, el Model de Simulació de Metàfores se centra a explicar com es produeixen els símptomes somàtics de la depressió (p. ex., retard psicomotor o postura encorbada) a partir de conceptes relacionats amb la cognició encarnada, metàfores conceptuals i imatgeria mental. Des d'aquest model, aquests símptomes es produeixen a causa que la desesperança experimentada en la depressió és conceptualitzada metafòricament com a incapacitat motora. Posteriorment, és simulada o recreada mentalment, donant lloc a l'experimentació de símptomes somàtics com la baixa energia o el retard psicomotor.

D'altra banda, la inclusió del cos en teràpia ha estat relegada a un paper molt secundari. Per això, diversos autors estan plantejant la necessitat de determinar i

sistematitzar les manipulacions corporals que podrien ser beneficioses en la modificació d'emocions i cognicions en teràpia (Folk et al., 2017). De fet, aquests autors han proposat l'abordatge de la cognició encarnada com un camp que té aplicacions clíniques clares com una intervenció sàvia (o *wise intervention*), un tipus d'intervenció que Walton (2014) va descriure com una intervenció breu i precisa, impulsada per la recerca i la teoria, en la qual el principal objectiu és un canvi en un procés psicològic específic que contribueix a alguns problemes.

En aquest sentit, només uns pocs estudis han analitzat l'efecte de la manipulació del cos com a estratègia coadjuvant en la teràpia cognitiu-conductual. Específicament, en el cas de les postures corporals, només un estudi ha analitzat el paper de la postura expansiva (*versus* contreta *versus* postura natural) com a estratègia per millorar la teràpia d'exposició en individus diagnosticats amb trastorn d'ansietat social (Davis et al., 2017), i els resultats apunten al fet que la postura no té un efecte significatiu sobre la severitat dels símptomes d'ansietat o els nivells hormonals de testosterona i cortisol. No obstant això, és un estudi que deixa diverses preguntes obertes que mereixen respostes (p. ex., Què efecte té la postura en altres resultats terapèutics? Es beneficiós adoptar-ne la postura durant l'exposició? Emfatitzar la manipulació de l'esquena modificaria els resultats?).

Folk et al. (2017) remarquen que l'ús de tècniques basades en les teories de la cognició encarnada es troba encara en els inicis i, per tant, se'n fa necessari l'estudi perquè s'hi utilitzen de forma sistemàtica junt amb la teràpia cognitiu-conductual o altres formes de teràpia. Per això, una meta proposada per alguns autors consisteix a incloure estratègies de "a baix-a dalt" (p. ex., dirigides a aspectes sensorials) en les teràpies que tradicionalment s'han caracteritzat per usar estratègies de " a dalt-a baix" (p. ex., dirigides a expressar continguts verbals de l'experiència) (Hauke, Lohr, i Pietrzak, 2017). De fet, alguns estudis experimentals suggereixen que la manipulació del cos és un bon inductor

d'emocions, similar a altres procediments tradicionals d'inducció emocional (p. ex., escoltar música, imaginació guiada, etc.) (Zhang, Yu, i Barrett, 2014), així com una estratègia de regulació emocional (Koole i Veenstra, 2015). D'acord amb Koole (2009), el cos és un sistema generador d'emocions, que ha de ser considerat en la regulació d'emocions. Aquest autor afirma que algunes estratègies cognitives no són més efectives que les estratègies corporals (p. ex., respiració controlada o relaxació muscular) a l'hora de mantenir un funcionament emocional general adequat. Posteriorment, Koole i Veenstra (2015) adopten un enfocament de la regulació emocional en el qual afirmen que la regulació de les emocions no només ocorre dins de la ment dels individus. Així doncs, aquests autors assenyalen que és possible regular implícitament les emocions a través dels canvis en l'expressió corporal de les mateixes (p. ex., a través de la postura).

En conclusió, les estratègies derivades de les teories de la cognició encarnada s'estan erigint com a eines potencials per ser utilitzades durant la teràpia. Així, l'evidència empírica mostra que els processos corporals, i concretament les postures corporals, poden actuar com activadores de determinades cognicions, inductores d'emocions, i/o com a estratègies de regulació emocional, que poden ajudar a millorar els resultats en la teràpia. No obstant això, es necessita més recerca per dilucidar els efectes que la manipulació del cos pot tenir com a estratègia coadjuvant de teràpies basades en l'evidència.

2. Objectius

La investigació que presentem en aquesta tesi doctoral té com a objectiu fonamental analitzar la influència d'adoptar una postura corporal expansiva i amb l'esquena dreta (*versus* contreta i encorbada) sobre diverses respostes cognitives i emocionals. Així doncs, els **objectius generals** són:

1) Analitzar l'efecte d'adoptar una postura corporal expansiva i amb l'esquena dreta (*versus* contreta i encorbada) abans i durant l'exposició a diversos estímuls ansiògens (associats a l'ansietat social i als trastorns alimentaris) sobre processos cognitius i emocionals.

2) Investigar l'efecte d'adoptar una postura amb l'esquena dreta (*versus* encorbada) en la modificació de dos mecanismes associats al manteniment de la depressió (els biaixos cognitius d'interpretació i les dificultats per a generar imatges mentals), així com en les emocions relacionades.

3) Explorar les possibles variables moderadors i mediadores que ens permeten conèixer millor *per a qui* i *com* es produeixen els efectes de la postura corporal en els processos cognitius i emocionals.

4) Aclarir les possibles implicacions clíniques de la manipulació de la postura corporal com a estratègia terapèutica per a la promoció de canvis cognitius i emocionals.

3. Metodologia i resultats

Per aconseguir aquests objectius, es van realitzar tres estudis experimentals en el context de laboratori, amb un disseny aleatoritzat inter-grup, amb dues condicions experimentals: postura corporal expansiva i/o amb l'esquena dreta (*versus* contreta i/o encorbada).

Els estudis 1 i 2 tenen com a objectiu analitzar el paper d'una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada) en l'exposició a estímuls ansiògens: una audiència (en el cas de l'estudi 1, en individus amb por a parlar en públic) i el propi cos (en el cas de l'estudi 2, en individus amb insatisfacció corporal). D'altra banda, l'estudi 3 té com a objectiu analitzar el paper de la postura amb l'esquena dreta (*versus* encorbada)

en els biaixos cognitius d'interpretació, les dificultats en imaginació positiva i les emocions associades a la depressió.

Per tant, el primer i segon estudi tenen com a objectiu principal l'anàlisi de l'efecte de la postura corporal com una estratègia per induir emocions i pensaments positius que ajuden a superar situacions estressants. Mentre que el tercer estudi té com a objectiu principal investigar com una postura corporal no associada amb la depressió (*versus* associada a la depressió), és a dir, una postura amb l'esquena dreta (*versus* encorbada) influeix en la disminució dels biaixos cognitius associats amb el manteniment de la depressió. En els següents subapartats es detallen els objectius específics, metodologia, resultats i conclusions de cada estudi experimental.

Finalment, cal assenyalar que tots els estudis han sigut aprovats pel Comitè d'Ètica de la Universitat de València i tots els participants han signat un consentiment informat abans d'iniciar la seua participació en l'estudi.

3.1. Estudi 1. Com la postura pot ajudar a donar un discurs oral: El paper de l'expansió de la postura en una tasca d'exposició.

L'estudi 1 es detalla en el capítol 2, i està fonamentat en el fet que les postures expansives i amb l'esquena dreta (*versus* contretes i encorbades) poden tenir un efecte beneficiós en el nivell emocional i cognitiu en tasques estressants (Cuddy et al., 2015; Nair et al., 2015) i en el fet que el paper de la postura corporal en el trastorn d'ansietat social ha estat escassament estudiat (Gilboa-Schechtman i Shachar-Lavie, 2013).

L'objectiu principal d'aquest estudi consisteix a analitzar l'efecte d'una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada) en l'afecte, els pensaments i les emocions negatives relacionades amb l'exposició, abans i durant un discurs oral, en dones amb por a parlar en públic. Així mateix, els objectius secundaris d'aquest estudis

consisteixen en: (1) analitzar si la por a parlar en públic és una variable que modera la relació entre la postura adoptada i l'afecte, les cognicions i les emocions negatives, tant abans com durant el discurs oral; (2) explorar si adoptar una postura específica es considera un facilitador, un impediment o irrellevant per realitzar el discurs oral; i (3) examinar l'efecte de la postura expansiva (*versus* contreta) en l'avaluació que fan les participants de la seua actuació en el discurs, de forma anticipatòria i una vegada realitzada la tasca.

La mostra va estar formada per 56 dones (M = 21.13, DT = 1.78 anys) amb una puntuació de moderada a alta en el nivell de por a parlar en públic (que equival a una puntuació ≥ 105 en *el* Qüestionari de Confiança per Parlar en Públic, Bados, 1986). Les participants van ser assignades a l'atzar a la condició "postura expansiva" i "postura contreta", en la qual el grau d'expansió dels braços i cames, així com la posició de l'esquena van ser manipulades d'acord als procediments de Carney et al. (2010) i Michalak et al. (2014). S'hi va encobrir l'objectiu principal de l'estudi i demanar a les participants que mantingueren la postura durant 2 minuts. Posteriorment, se'ls va informar que la tasca consistia a realitzar un discurs oral davant d'una audiència que anava a ser gravada en vídeo. Per a això, s'hi va seguir el procediment de la Tasca del Discurs Improvisat (Beidel, Turner, Jacob, i Cooley, 1989). Les participants van preparar el discurs durant 3 minuts i, seguidament, realitzaren un discurs oral de 3 minuts de durada. Així mateix, s'hi demanava a les participants que mantingueren aquesta postura durant tot el procediment.

S'hi va mesurar l'afecte (Escala d'Afecte Positiu i Negatiu, PANAS, Sandin et al., 1999), els pensaments (Escala d'Autoverbalitzacions durant la Situació de Parlar en Públic; SSPS, Rivero et al., 2010), i les emocions negatives (Escala d'Emocions Negatives construïda *ad-hoc*) en la línia base, abans i durant el discurs.

S'hi van realitzar ANCOVAs de mesures repetides, anàlisis de moderació, anàlisi de chi-quadrat, i proves t de mostres independents. Els resultats principals van mostrar que les participants en la condició expansiva (*versus* contreta) tenien, en mitjana, un menor nivell de pensaments negatius abans i durant el discurs oral, $F(1,53) = 4.61$, $p = .036$, $\eta^2_p = .08$. Així mateix, les participants en la condició expansiva (*versus* contreta) amb majors nivells de por a parlar en públic presentaven menors nivells d'afecte negatiu abans de donar el discurs, $F(1,51) = 4.04$, $p = .050$, 95% CI [0.001, 0.383]. No obstant això, un gran percentatge de participants en ambdues condicions van considerar que adoptar una postura determinada era un impediment per realitzar el discurs oral (44.4% en la condició expansiva i 65.5% en la condició contreta).

Com es pot observar, els beneficis d'adoptar una postura determinada en l'afecte i els pensaments només s'observen abans de donar el discurs –i en el cas de l'afecte, només en aquelles dones amb majors nivells de por a parlar en públic–. De fet, sembla que adoptar una postura específica durant la tasca ansiògena constitueix un impediment més que un facilitador. Per tant, els resultats assenyalen la necessitat de realitzar estudis que exploren l'efecte d'adoptar una postura expansiva (*versus* contreta) abans de la situació estressant i durant un breu període de temps. Així doncs, es conclou que l'adopció d'una postura expansiva abans de la situació estressant podria actuar com un inductor d'apoderament cap a un mateix. Per contra, adoptar una postura expansiva durant la situació estressant podria experimentar-se com un intent d'exercir poder sobre els altres. En aquest estudi s'assenyala la necessitat d'explorar els efectes en població clínica, de monitoritzar la postura de forma objectiva amb sensors posturals, així com d'explorar els beneficis de manipular la postura abans de l'exposició a estímuls ansiògens. Així doncs, es necessiten més estudis que permeten dilucidar si evitar una postura contreta o promoure

una postura expansiva presenta beneficis terapèutics abans o durant l'exposició a una situació ansiògena.

3.2. Estudi 2. Expandeix el teu cos quan et mires a l'espill: El paper de la postura en una tasca d'exposició a l'espill.

Aquest estudi experimental es detalla en el capítol 3. De manera similar a l'estudi 1, aquest està fonamentat en el fet que les postures expansives i amb l'esquena dreta (*versus* contretes i encorbades) poden tenir un efecte beneficiós a nivell emocional i cognitiu en tasques estressants (Cuddy et al., 2015; Nair et al., 2015). En el cas del tractament dels trastorns alimentaris, l'exposició a l'espill és un dels principals components. De fet, ha demostrat la seua eficàcia per millorar diversos resultats terapèutics (p. ex., insatisfacció corporal) (Koskina, Campbell, i Schmidt, 2013; Trentowska, Svaldi, i Tuschen-Caffier, 2014). No obstant això, fins avui, no s'han realitzat estudis que hagen analitzat quin és la postura corporal que hauria d'adoptar-se per maximitzar l'eficàcia d'aquesta tècnica.

L'objectiu principal d'aquest estudi va consistir a analitzar l'efecte d'adoptar una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada), abans de realitzar una tasca d'exposició a l'espill, en les emocions i cognicions relacionades amb el propi cos, en dones que presentaven insatisfacció corporal. Els objectius secundaris van consistir en: (1) explorar les emocions experimentades amb major freqüència per les participants durant l'adopció de cada postura; (2) analitzar si l'índex de massa corporal és una variable que modera l'efecte de la postura en el canvi en les emocions i cognicions després de l'exposició al propi cos; i (3) explorar les variables que estan mediant la relació entre la postura i el canvi en les emocions i cognicions després de l'exposició al propi cos.

La mostra va estar composta per 68 dones, amb una edat mitjana de M = 21.74 (DT = 3.12), puntuacions de lleus a altes en insatisfacció corporal (≥ 81 en *el* Qüestionari de Forma Corporal, BSQ, Raich et al., 1996), i un índex de massa corporal mitjà de M = 22.60 (DT = 2.66). Les participants van ser assignades aleatòriament a la "condició expansiva" o a la "condició contreta", en el qual es va manipular l'obertura dels braços i les cames, i la posició dels muscles, coll i esquena seguint el procediment de Cuddy et al. (2015). Així mateix, la postura va ser monitoritzada per un dispositiu electrònic amb l'objectiu d'assegurar de manera objectiva que cadascuna de condicions estava mantenint la postura assignada. Las participants van completar diverses mesures autoinformades, abans d'adoptar la postura i després de realitzar la tasca d'exposició a l'espill, per avaluar les emocions positives i negatives (qüestionari *ad-hoc*), els pensaments negatius durant la tasca (Llistat de Pensaments, TCL, Cooper i Fairburn, 1992), la imatge corporal estat (Escala d'Imatge corporal Estat, BISS, Cash, Fleming, Alindogan, Steadman, i Whitehead, 2002), i l'avaluació de les descripcions que les pròpies participants atorgaven sobre el seu propi cos (qüestionari *ad-hoc*).

Cal esmentar que la postura va ser adoptada durant 2 minuts, encobrint-se els efectes esperats de la postura, i que les participants van realitzar una adaptació de la tasca d'exposició a l'espill seguit per Luethcke, McDaniel, i Becker (2011) i Delinsky i Wilson (2006).

S'hi van realitzar ANCOVAs unifactorials, anàlisi de chi-quadrat, proves t de mostres independents, i anàlisis de moderació, de mediació i de mediació moderada. Els resultats principals van ser que les participants que van adoptar una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada) van mostrar emocions positives (autoconfiança i felicitat) més altes després de la tasca d'exposició a l'espill, $F(1,65)$ = 8.10, p = .006, η_p^2 = .11. Aquest resultat convergeix amb les diferències trobades quant

a les emocions experimentades en cada condició durant l'adopció de cada postura: un major percentatge de participants en la condició expansiva va experimentar més autoconfiança que en la condició encorbada (80% *versus* 20%), i un major percentatge de participants en la condició encorbada va experimentar més submissió (100% *versus* 0%) i inseguretat (73.7% *versus* 26.3%) que en la condició expansiva. Així mateix, les anàlisis de mediació de tipus exploratori van mostrar que l'adopció d'una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada) va generar un major canvi en les emocions positives, la qual cosa va conduir a puntuacions més baixes en emocions negatives, *Efecte indirecte* = 0.37 (0.15), 95% IC [0.12, 0.73], i a puntuacions majors en imatge corporal estat, *Efecte indirecte* = -0.33 (0.14), 95% IC [-0.64, -0.09] i en l'avaluació positiva del propi cos, *Efecte indirecte* = -0.21 (0.11), 95% IC [-0.51, -0.06], després de la tasca d'exposició a l'espill. Així mateix, les anàlisis de moderació van mostrar que l'índex de massa corporal moderava la relació entre la postura i la imatge corporal estat, $F(1,63) = 5.86$, $p = .018$, de manera que les participants amb menor índex de massa corporal es beneficiaven més d'adoptar aquesta postura. No obstant això, les anàlisis de mediació moderada van mostrar que aquest efecte desapareixia quan s'introduïa en la mateixa anàlisi l'efecte indirecte de les emocions positives, *Efecte indirecte* = 0.09 (0.07), 95% CI [-0.05, 0.23].

Per tant, aquest estudi suggereix que la postura corporal expansiva és un inductor d'emocions positives, que ajuda a millorar diferents respostes cognitives i emocionals que sorgeixen quan una persona amb insatisfacció corporal és exposada al seu propi cos. No obstant això, és necessari investigar els efectes que aquesta manipulació corporal té en mostres clíniques dins de les teràpies establertes per als trastorns alimentaris, ja que encara queda per dilucidar com, quan i per a qui la postura expansiva és una estratègia coadjuvant en la tècnica d'exposició al propi cos.

3.3. Estudi 3. L'efecte d'una postura amb l'esquena dreta (*versus* encorbada) en els biaixos d'interpretació, imaginació i emocions.

Aquest estudi experimental es desenvolupa en el capítol 4. Part de la base que, tot i que existeix evidència dels efectes positius d'adoptar una postura amb l'esquena dreta (*versus* encorbada) en els processos emocionals i cognitius (p. ex., Michalak et al., 2014; Veenstra et al., 2016), fins al moment no s'ha analitzat l'efecte d'aquestes postures sobre dos processos clau associats amb el manteniment de la depressió assenyalats en el model de Holmes, Lang, i Deeprose (2009): els biaixos cognitius d'interpretació i les dificultats en la generació de les imatges mentals.

L'objectiu principal d'aquest estudi era analitzar l'efecte d'una postura amb l'esquena dreta (*versus* encorbada) en la interpretació cognitiva de la informació ambigua i la vivesa amb la qual es generen imatges mentals positives i negatives. D'altra banda, els objectius secundaris van consistir en: (1) analitzar l'efecte d'adoptar una postura amb l'esquena dreta (*versus* encorbada) en les respostes emocionals (p. ex., tristesa, felicitat); (2) explorar la relació entre el percentatge de temps adoptant una postura amb l'esquena dreta (determinada pels sensors posturals col·locats en la part alta de l'esquena) i el canvi en el biaix d'interpretació, la vivesa en la imaginació i les emocions associades a la depressió; i (3) analitzar si la simptomatologia depressiva és una variable moderadora en l'efecte que exerceix la postura sobre el biaix d'interpretació i la vivesa en la imaginació.

La mostra va estar composta per 54 participants que presentaven un ampli rang de simptomatologia depressiva d'acord amb l'Inventari de Depressió de Beck (BDI-II; Beck et al., 1996): absència de simptomatologia depressiva, o simptomatologia mínima, lleu i moderada. L'edat mitjana de la mostra va ser de 22.00 (*DT* = 2.84), el 64.8% van ser dones i la puntuació mitjana en el BDI-II va ser de 9.39 (*DT* = 7.60, rang entre 0 i 26). Els participants van ser assignats aleatòriament a la condició amb l'esquena dreta (*n* =

26) o encorbada (n = 28). La postura va ser manipulada seguint un procediment similar al descrit per Michalak et al. (2014).

Els participants van respondre autoinformes, abans d'adoptar la postura corporal i durant l'adopció de la mateixa, amb l'objectiu d'avaluar el biaix d'interpretació (Test d'Escenaris Ambigus, AST-D-II, Rohrbacher i Reinecke, 2014), la vivesa de la generació d'imatges mentals positives i negatives (Tasca Prospectiva d'Imatges Mentals, PIT, Holmes et al., 2008) i les emocions relacionades amb la depressió (Escala d'emocions construïda *ad-hoc* i el Perfil d'Estats d'Ànim, POMS, Andrade, Arce, de Francisco, Torrado, i Garrido, 2013). La posició de l'esquena es va controlar mitjançant sensors posturals de tecnologia inercial, que avaluaven la inclinació de la part alta de l'esquena.

Els resultats derivats de les ANCOVAs van mostrar que els participants que van adoptar una postura amb l'esquena dreta (*versus* encorbada) realitzaven interpretacions més positives d'informació ambigua, $F(1,51) = 4.82$, $p = .033$, $\eta_p^2 = .09$, mostraven emocions positives més elevades (felices i optimistes), $F(1,51) = 7.69$, $p = .008$, $\eta_p^2 = .13$, i major vigor, $F(1,51) = 6.07$, $p = .017$, $\eta_p^2 = .11$. D'altra banda, les correlacions de Pearson van mostrar que el percentatge de temps en una postura corporal amb l'esquena dreta s'associava positivament amb el canvi en el biaix cognitiu d'interpretació ($r = .35$, $p = .014$) i la vivesa amb la qual es generaven imatges mentals positives ($r = .44$, $p = .002$). Finalment, les anàlisis de moderació van mostrar que el nivell de simptomatologia depressiva moderava l'efecte de la postura sobre el canvi en el biaix d'interpretació, $F(1,49) = 4.75$, $p = .034$, $R^2 = 0.012$. És a dir, a majors nivells de simptomatologia depressiva, major impacte tenia la manipulació de la postura en la manera d'interpretar la informació ambigua.

Aquest estudi indica que la postura corporal interactua amb mecanismes implicats en l'etiologia i manteniment de la depressió (biaixos cognitius d'interpretació i vivesa en

la imaginació), així com amb les emocions relacionades amb la depressió (felicitat, optimisme i vigor). Aquest estudi té implicacions teòriques i clíniques que han de ser explorades amb l'objectiu d'aclarir el paper de la postura corporal en la depressió.

4. Conclusions i discussió

Com s'ha exposat al llarg de la tesi doctoral, els processos corporals són fonts valuoses d'informació que contribueixen a donar forma a les nostres emocions i pensaments. No obstant això, com també s'hi ha assenyalat, els efectes derivats de la cognició encarnada no han sigut quasi estudiats en el camp de la psicopatologia i la psicologia clínica. En conseqüència, les teràpies actuals basades en l'evidència no s'han beneficiat tot el possible de l'ús de les estratègies relacionades amb el cos, que podrien ajudar a enriquir i millorar els resultats terapèutics. Així doncs, la investigació que presenta aquesta tesi doctoral va sorgir de la necessitat d'omplir aquest buit en la literatura científica, amb l'objectiu últim d'investigar com les estratègies relacionades amb el cos −i específicament, les manipulacions de la postura corporal− podrien ser utilitzades amb finalitats terapèutiques.

Amb aquesta finalitat, s'hi han dut a terme tres estudis experimentals, amb l'objectiu comú d'analitzar la influència d'adoptar una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada) en diverses respostes cognitives i emocionals. En els següents paràgrafs s'exposaran les conclusions generals, responent a cadascun dels objectius generals d'aquesta tesi:

(1) Efectes de la manipulació postural en l'exposició a estímuls ansiògens. Els resultats de tots dos estudis suggereixen que adoptar una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada) va influir en la resposta cognitiva i emocional de les dones, fent-les "sentir i pensar menys negativament" abans de l'exposició (en el cas de donar un

discurs davant d'una audiència, en dones amb por a parlar en públic), i fent-les "sentir i pensar més positivament" després de l'exposició (en el cas d'observar i descriure el seu propi cos, en dones amb insatisfacció corporal). Les troballes derivades dels estudis 1 i 2 suggereixen que l'adopció d'una postura expansiva i amb l'esquena dreta podria usar-se com a coadjuvant d'un procediment d'inducció emocional (Zhang et al., 2014), és a dir, com un procediment afegit que podria potenciar l'evocació d'una experiència emocional i cognitiva requerida (p. ex., estar més preparada o empoderada per manejar la situació).

(2) Efectes de la postura en els mecanismes associats amb el manteniment de la depressió i emocions associades. La resposta a aquest objectiu va ser atorgada per l'estudi 3, els resultats del qual van mostrar que la postura corporal interactuava amb mecanismes implicats en el manteniment de la depressió (biaixos cognitius d'interpretació i dificultats en la generació d'imatges mentals), així com amb emocions que tendeixen a estar disminuïdes en la depressió. Així doncs, aquells participants que van adoptar una postura amb l'esquena dreta (*versus* encorbada) van interpretar la informació ambigua de manera més positiva i van experimentar més emocions positives. Com en l'estudi 2, sembla que la postura amb l'esquena dreta va permetre als individus "pensar i sentir d'una manera més positiva". Tal com van proposar Koole i Veenstra (2015), els resultats derivats de l'estudi 3 suggereixen que la postura podria ser usada com una estratègia per regular les emocions de manera implícita, és a dir, com un procés dirigit a canviar la qualitat, la intensitat o la durada de la resposta emocional sense una intenció explícita.

(3) Variables mediadoras i moderadores dels efectes de la postura. Els resultats derivats de les anàlisis de mediació i moderació suggereixen que els individus que més es beneficien d'adoptar una postura expansiva i/o amb l'esquena dreta (*versus* contreta i/o encorbada) són aquells que presenten una simptomatologia més elevada de por a parlar en públic i una simptomatologia depressiva major. En conseqüència, els resultats

indiquen que els individus que sofreixen simptomatologia més elevada constituirien la "població diana", en la qual ha d'encoratjar-se l'adoptació d'una una postura expansiva i amb l'esquena dreta, o l'evitació d'una postura contreta i encorbada. Respecte a les anàlisis de mediació, els resultats derivats de l'estudi 2 suggereixen que l'increment de les emocions positives (felicitat i autoconfiança) en aquelles dones que van adoptar una postura expansiva i amb l'esquena dreta (*versus* contreta i encorbada) constituïa el mecanisme pel qual es generava el canvi en variables relacionades amb la imatge corporal (p. ex., valoració del propi cos).

D'acord amb Körner et al. (2015), els canvis en els estats corporals derivats d'haver deixat a les dones tot sol amb la postura, sense realitzar cap altra tasca, podrien haver alterat directament l'estat emocional a través del mecanismes de "inducció directa d'un estat determinat" −un mecanisme que sembla ser universal i filogenèticament adquirit−. En contraposició, el mecanisme responsable de no trobar resultats significatius en l'estudi 1 va poder deure's a la posada en funcionament del segon mecanisme proposat per Körner et al. (2015), anomenat "efecte de facilitació modal", en el qual es van activar conceptes abstractes idiosincràtics associats a la postura expansiva (p. ex., conceptes de dominància sobre els altres, en el cas de por a parlar en públic).

(4) Possibles implicacions de la postura corporal en teràpia. Els tres estudis duts a terme ens permeten realitzar un primer acostament en la delimitació de com es pot incloure el cos en la teràpia. D'una banda, els terapeutes podrien encoratjar als pacients a adoptar una postura expansiva i amb l'esquena dreta abans d'enfrontar-se a una sessió d'exposició durant un curt període de temps amb la finalitat de "empoderar-se". No obstant això, com s'ha discutit prèviament en l'estudi 1 i l'estudi 2, és necessari avaluar si aquests canvis afectius i cognitius en l'exposició a estímuls ansiògens tenen conseqüències negatives o positives per a la teàpia a curt i llarg termini (p.ej., La postura impedeix activar una

resposta negativa necessària durant l'exposició? La postura augmenta l'adherència a la tècnica d'exposició? La postura augmenta l'autoconfiança per enfrontar una situació estressant?). D'altra banda, els terapeutes podrien dur a terme la correcció de la postura dels seus pacients durant les sessions terapèutiques, especialment quan s'està treballant en la modificació d'un biaix cognitiu o les emocions que poden estar diminuides en pacients amb depressió. Així doncs, la postura podria actuar com una estratègia de regulació emocional i de facilitació del canvi de biaixos cognitius. No obstant això, es requereix una major evidència empírica per poder realitzar recomanacions més sòlides en el context clínic.

La investigació de la tesi doctoral té fortaleses que atorguen solidesa als principals resultats. Aquestes fortaleses són: (1) realització de tres estudi aleatorizats experimentals que compleixen amb els requisits indispensables per aconseguir una adequada validesa interna; (2) recerca en un tema nou, en el qual diversos autors estan reclamant major evidència empírica; (3) intent de dilucidar en quin moment i durant quan temps la postura ha de ser adoptada, com es produeixen els efectes encarnats i per a qui són més beneficiosos els efectes de la postura; i (4) desenvolupament i ús de sensors de la postura corporal que permeten monitoritzar la postura de manera objectiva.

No obstant això, la investigació no està exempta de limitacions que, és important recordar, són comunes a tots els estudis. Són les següents: (1) realització dels tres estudis en mostra no clínica i en estudiants –i únicament en dones en el cas dels estudis 1 i 2–; (2) realització dels tres estudis en un context de laboratori, no clínic, la qual cosa comporta un augment de la validesa interna a canvi d'una pèrdua de validesa externa o generalització dels resultats a població clínica (Roth i Fonagy, 2013); (3) carència d'una condició experimental control, en la qual no s'adopte una postura específica; (4) absència de validació dels sensors corporals utilitzats en l'estudi 2 i 3; i (5) no mesurament de la

resposta fisiològica dels individus, la qual cosa ajudaria a dilucidar els mecanismes pels quals es produeixen efectes cognitius i emocionals deguts a la postura corporal.

Com a futures direccions, a més d'esmenar les limitacions anteriors, seria recomanable: (1) replicar les troballes en diferents mostres, o dur a terme xicotetes modificacions als experiments amb la finalitat de desentranyar *què postura* és adequada *per a quin trastorn mental*, *en quin moment* i per canviar *què resultat específic*; (2) investigar si és necessari manipular l'expansió del cos (com en l'estudi 1 i 2), o és suficient amb la manipulació de l'esquena, el coll i els muscles dels individus (com en l'estudi 3) per aconseguir resultats específics; (3) analitzar els efectes emocionals i cognitius d'adoptar una postura desconeixent els efectes corporals de la postura *versus* coneixent els efectes de la postura corporal (p. ex., a partir d'una breu psicoeducació); (4) explorar com la manipulació del cos pot ser integrada en la vida diària del pacient (p. ex., a través d'aplicacions mòbils) i els seus efectes a llarg termini; (5) traslladar les troballes en el laboratori al context clínic (p. ex., a través d'estudis de cas únic); i (6) continuar investigant els mecanismes responsables dels efectes de la cognició encarnada.

En conclusió, la investigació que presenta la tesi doctoral proporciona evidències de la influència que exerceix la postura corporal en el processament de la informació a través de tres estudis experimentals, en mostres amb simptomatologia diversa (por a parlar en públic, insatisfacció corporal i simptomatologia depressiva). Els resultats assenyalen que adoptar una postura expansiva i amb l'esquena dreta (*versus* una postura contreta i encorbada) té efectes beneficiosos sobre diversos processos emocionals i cognitius. No obstant això, els efectes encarnats de la postura requereixen seguir sent investigats, ja que només la recerca ens ajudarà a dilucidar com, quan, per a qui i per què adoptar una postura corporal específica podria ser beneficiós en el context terapèutic, com una estratègia coadjuvant de les actuals teràpies basades en l'evidència.

5. Referències

Anderson, J. R. (1983). *The architecture of cognition.* Cambridge, MA: Harvard University Press.

Andrade, E., Arce, C., De Francisco, C., Torrado, J., i Garrido, J. (2013). Versión breve en español del cuestionario POMS para deportistas adultos y población general. *Revista de psicología del deporte*, *22*(1), 59-102.

Bados, A. (1986). *Análisis de componentes de un tratamiento cognitivo-somático-conductual del miedo a hablar en público*. Tesis doctoral no publicada, University of Barcelona, Barcelona.

Barnard, P. J., i Teasdale, J. D. (1991). Interacting cognitive subsystems: A systemic approach to cognitive-affective interaction and change. *Cognition & Emotion, 5*(1), 1-39. doi: 10.1080/02699939108411021

Barsalou, L. W. (1999). Perceptions of perceptual symbols. *Behavioral and brain sciences, 22*(4), 637-660. doi: 10.1017/S0140525X99532147

Barsalou, L. W. (2008). Grounded Cognition. *Annual Review of Psychology*, *59*(1), 617–645. doi: 10.1146/annurev.psych.59.103006.093639

Barsalou, L. W. (2015). Situated Conceptualization : Theory and Application. En Y. Coello y M. H. Fischer (Eds.), *Foundations of embodied cognition*. East Sussex, UK: Psychology Press.

Beck, A. T., Steer, R. A., i Brown, G. K. (1996). *Beck Depression Inventory Manual.* San Antonio, TX: The Psychological Corporation.

Beidel, D. C., Turner, S. M., Jacob, R. G., i Cooley, M. R. (1989). Assessment of social phobia: Reliability of an impromptu speech task. *Journal of anxiety disorders, 3*(3), 149-158. doi: 10.1016/0887-6185(89)90009-1

Briñol, P., Petty, R. E., i Wagner, B. (2009). Body posture effects on self-evaluation: A self-validation approach. *European Journal of Social Psychology*, *39*(6), 1053-1064. doi: 10.1002/ejsp.607

Cacioppo, J. T., Priester, J. R., i Berntson, G. G. (1993). Rudimentary determinants of attitudes: II. Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology*, *65*(1), 5–17. doi: 10.1037/0022-3514.65.1.5

Carney, D. R., Cuddy, A. J. C., i Yap, A. J. (2010). Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science*, *21*(10), 1363–1368. doi: 10.1177/0956797610383437

Carney, D. R., Cuddy, A. J. C., i Yap, A. J. (2015). Review and Summary of Research on the Embodied Effects of Expansive (vs. Contractive) Nonverbal Displays. *Psychological Science*, *26*(5), 657–663. doi: 10.1177/0956797614566855

Cash, T.F., Fleming, E.C., Alindogan, J., Steadman, L., i Whitehead, A. (2002). Beyond body image as a trait: The development and validation of the Body Image States Scale. *Eating Disorders: The Journal of Treatment & Prevention, 10,* 103–113. doi: 10.1080/10640260290081678

Cooper, M. J., i Fairburn, C. G. (1992). Thoughts about eating, weight and shape in anorexia nervosa and bulimia nervosa. *Behaviour Research and Therapy, 30*(5), 501–511. doi: 10.1016/0005-7967(92)90034-E

Cuddy, A. J. C., Schultz, S. J., i Fosse, N. E. (2018). P-Curving a More Comprehensive Body of Research on Postural Feedback Reveals Clear Evidential Value For Power-Posing Effects: Reply to Simmons and Simonsohn (2017). *Psychological Science*, *29*(4), 656-666. doi: 10.1177/0956797617746749

Cuddy, A. J. C., Wilmuth, C. A., Yap, A. J., i Carney, D. R. (2015). Preparatory power posing affects nonverbal presence and job interview performance. *Journal of Applied Psychology*, *100*(4), 1286–1295. doi: 10.1037/a0038543

Davis, M. L., Papini, S., Rosenfield, D., Roelofs, K., Kolb, S., Powers, M. B., i Smits, J. A. J. (2017). A randomized controlled study of power posing before public speaking exposure for social anxiety disorder: No evidence for augmentative effects. *Journal of Anxiety Disorders*, *52*(Dec), 1–7. doi: 10.1016/j.janxdis.2017.09.004

Delinsky, S. S., i Wilson, G. T. (2006). Mirror exposure for the treatment of body image disturbance. *International Journal of Eating Disorders, 39*(2), 108–116. doi:10.1002/eat.20207

Folk, J. B., Disabato, D. J., Goodman, F. R., Carter, S. P., DiMauro, J. C., i Riskind, J. H. (2017). Wise additions bridge the gap between social psychology and clinical practice: Cognitive-behavioral therapy as an exemplar. *Journal of Psychotherapy Integration*, *27*(3), 407–423. doi: 10.1037/int0000038

Förster, J. (2003). The influence of approach and avoidance motor actions on food intake. *European Journal of Social Psychology*, *33*(3), 339–350. doi: 10.1002/ejsp.150

Gilboa-Schechtman, E., i Shachar-Lavie, I. (2013). More than a face: a unified theoretical perspective on nonverbal social cue processing in social anxiety. *Frontiers in human neuroscience, 7*, 904. doi: 10.3389/fnhum.2013.00904

Glenberg, A. M. (2010). Embodiment as a unifying perspective for psychology. *European Journal of Social Psychology*, *39*(7), 1135–1141. doi: 10.1002/ejsp.670

Glenberg, A. M., Witt, J. K., i Metcalfe, J. (2013). From the Revolution to Embodiment: 25 Years of Cognitive Psychology. *Perspectives on Psychological Science*, *8*(5), 573–585. doi: 10.1177/1745691613498098

Gronau, Q. F., Van Erp, S., Heck, D. W., Cesario, J., Jonas, K. J., i Wagenmakers, E.-J. (2017). A Bayesian model-averaged meta-analysis of the power pose effect with informed and default priors: the case of felt power. *Comprehensive Results in Social Psychology*, *2*(1), 123–138. doi: 10.1080/23743603.2017.1326760

Hauke, G., Lohr, C., i Pietrzak, T. (2017). Moving the mind: Embodied cognition in Cognitive Behavioural Therapy (CBT). *European Psychotherapy*, 154–178.

Havas, D. A., Glenberg, A. M., Gutowski, K. A., Lucarelli, M. J., i Davidson, R. J. (2010). Cosmetic use of botulinum toxin-a affects processing of emotional language. *Psychological Science, 21*(7), 895–900. doi: 10.1177/0956797610374742

Holmes, E. A., Lang, T. J., i Deeprose, C. (2009). Mental imagery and emotion in treatment across disorders: Using the example of depression. *Cognitive Behaviour Therapy*, *38*(S1), 21-28. doi: 10.1080/16506070902980729

Holmes, E. A., Lang, T. J., Moulds, M. L., i Steele, A. M. (2008). Prospective and positive mental imagery deficits in dysphoria. *Behaviour research and therapy*, *46*(8), 976-981. doi: 10.1016/j.brat.2008.04.009

Hurley, S. (2001). Perception and Action: Alternative Views. *Cognition, 129*(1), 3–40. doi: 10.1111/1467-8349.00078

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition and Emotion*, *23*(1), 4–41. doi: 10.1080/02699930802619031

Koole, S. L., i Veenstra, L. (2015). Does Emotion Regulation Occur Only Inside People's Heads? Toward a Situated Cognition Analysis of Emotion-Regulatory Dynamics. *Psychological Inquiry*, *26*(1), 61–68. doi: 10.1080/1047840X.2015.964657

Körner, A., Topolinski, S., i Strack, F. (2015). Routes to embodiment. *Frontiers in Psychology*, *6*(940), 1–10. doi: 10.3389/fpsyg.2015.00940

Koskina, A., Campbell, I. C., y Schmidt, U. (2013). Exposure therapy in eating disorders revisited. *Neuroscience & Biobehavioral Reviews*, *37*(2), 193–208. doi: 10.1016/j.neubiorev.2012.11.010

Lakoff, G., i Johnson, M. (1980). *Metaphors we live by.* Chicago, IL: University of Chicago Press.

Lakoff, G., i Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought.* New York: Basic Books.

Lang, P. J. (1979). A Bio-Informational Theory of Emotional Imagery. *Psychophysiology*, *16*(6), 495-512. doi: 10.1111/j.1469-8986.1979.tb01511.x

Lindeman, L. M., i Abramson, L. Y. (2008). The Mental Simulation of Motor Incapacity in Depression. *Journal of Cognitive Psychotherapy*, *22*(3), 228–249. doi: 10.1891/0889-8391.22.3.228

Luethcke, C. A., McDaniel, L., i Becker, C. B. (2011). A comparison of mindfulness, nonjudgmental, and cognitive dissonance-based approaches to mirror exposure. *Body Image*, *8*(3), 251–258. doi:10.1016/j.bodyim.2011.03.006

Michalak, J., Mischnat, J., i Teismann, T. (2014). Sitting posture makes a difference-embodiment effects on depressive memory bias. *Clinical Psychology and*

Psychotherapy, *21*(6), 519–524. doi: 10.1002/cpp.1890

Michalak, J., Rohde, K., i Troje, N. F. (2015). How we walk affects what we remember: Gait modifications through biofeedback change negative affective memory bias. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 121–125. doi: 10.1016/j.jbtep.2014.09.004

Michalak, J., Troje, N. F., Fischer, J., Vollmar, P., Heidenreich, T., i Schulte, D. (2009). Embodiment of sadness and depression-gait patterns associated with dysphoric mood. *Psychosomatic Medicine*, *71*(5), 580–587. doi: 10.1097/PSY.0b013e3181a2515c

Nair, S., Sagar, M., Sollers, J., Consedine, N., i Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology*, *34*(6), 632–641. doi: 10.1037/hea0000146

Newel, A., i Simon, H. A. (1976). Computer Science as empirical Inquiry: Symbols and Search. *Communications of the ACM*, *19*(3), 113–126. doi: 10.1145/360018.360022

Niedenthal, P. M. (2007). Embodying emotion. *Science*, *316*(5827), 1002–1005. doi: 10.1126/science.1136930

Niedenthal, P. M., Winkielman, P., Mondillon, L., i Vermeulen, N. (2009). Embodiment of Emotion Concepts. *Journal of Personality and Social Psychology*, *96*(6), 1120–1136. doi: 10.1037/a0015574

Peper, E., i Lin, I. M. (2012). Increase or Decrease Depression: How Body Postures Influence Your Energy Level. *Biofeedback*, *40*(3), 125–130. doi: 10.5298/1081-5937-40.3.01

Price, T. F., Peterson, C. K., i Harmon-Jones, E. (2012). The emotive neuroscience of embodiment. *Motivation and Emotion*, *36*(1), 27–37. doi: 10.1007/s11031-011-9258-1

Rahona, J. J., Ruiz Fernández, S., Rolke, B., Vázquez, C., i Hervás, G. (2014). Overt head movements moderate the effect of depressive symptoms on mood regulation. *Cognition and Emotion*, *28*(7), 1328–1337. doi: 10.1080/02699931.2014.881323

Raich, R.Mª, Mora, M., Soler, A., Ávila, C., Clos, I., i Zapater, I. (1996). Adaptación de un instrumento de evaluación de la insatisfacción corporal. *Clínica y Salud*, *7*(1), 51–66.

Rivero, R., Garcia-Lopez, L., i Hofmann, S. G. (2010). The Spanish Version of the Self-Statements During Public Speaking Scale. *European Journal of Psychological Assessment, 26,* 129-135. doi: 10.1027/1015-5759/a000018.

Rohrbacher, H., i Reinecke, A. (2014). Measuring change in depression-related interpretation bias: development and validation of a parallel ambiguous scenarios test. *Cognitive behaviour therapy*, *43*(3), 239-250. doi: 10.1080/16506073.2014.919605

Roth, A., i Fonagy, P. (2013). *What works for whom?: a critical review of psychotherapy research.* New York, NY: Guilford Publications.

Sandín, B., Chorot, P., Lostao, L., Joiner, T. E., Santed, M. A., i Valiente, R. M. (1999). Escalas PANAS de afecto positivo y negativo: validación factorial y convergencia transcultural. *Psicothema*, *11*(1), 37-51.

Smith, E.R., i Semin, G.R. (2004). Socially situated cognition: Cognition in its social context.. *Advances in experimental social psychology, 36*, 53-117.

Teasdale, J. D., i Barnard, P. J. (1993). *Affect, cognition and change: Remodelling depressive thought*. Hove, East Sussex: Psychology Press.

Trentowska, M., Svaldi, J., i Tuschen-Caffier, B. (2014). Efficacy of body exposure as treatment component for patients with eating disorders. *Journal of Behavior Therapy and Experimental Psychiatry*, *45*(1), 178–185. doi: 10.1016/j.jbtep.2013.09.010

Tsai, H. Y., Peper, E., i Lin, I. M. (2016). EEG patterns under positive/negative body postures and emotion recall tasks. *NeuroRegulation*, *3*(1), 23–27. doi: 10.15540/nr.3.1.23

Veenstra, L., Schneider, I. K., i Koole, S. L. (2016). Embodied mood regulation: the impact of body posture on mood recovery, negative thoughts, and mood-congruent recall. *Cognition and Emotion*, *31*(7), 1361–1376. doi: 10.1080/02699931.2016.1225003

Walton, G. M. (2014). The New Science of Wise Psychological Interventions. *Current Directions in Psychological Science*, *23*(1), 73–82. doi: 10.1177/0963721413512856

Wells, G. L., i Petty, R. E. (1980). The effects of over head movements on persuasion: Compatibility and incompatibility of responses. *Basic and Applied Social Psychology, 1*(3), 219-230. doi: 10.1207/s15324834basp0103_2

Wiers, R. W., Eberl, C., Rinck, M., Becker, E. S., i Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science*, *22*(4), 490–497. doi: 10.1177/0956797611400615

Wilkes, C., Kydd, R., Sagar, M., i Broadbent, E. (2017). Upright posture improves affect and fatigue in people with depressive symptoms. *Journal of Behavior Therapy and Experimental Psychiatry, 54*, 143–149. doi: 10.1016/j.jbtep.2016.07.015

Winkielman, P., Niedenthal, P., Wielgosz, J., Eelen, J., i Kavanagh, L.C. (2015). Embodiment of cognition and emotion. En M. Mikulincer, P.R. Shaver, E. Borgida, J.A. Bargh (Eds.), *APA handbooks in psychology. APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 151-175). Washington, DC, US: American Psychological Association.

Wollmer, M. A., De Boer, C., Kalak, N., Beck, J., Götz, T., Schmidt, T., …i Kruger, T.

H. C. (2012). Facing depression with botulinum toxin: A randomized controlled trial. *Journal of Psychiatric Research*, *46*(5), 574–581. doi: 10.1016/j.jpsychires.2012.01.027

Zhang, X., Yu, H. W., i Barrett, L. F. (2014). How does this make you feel? A comparison of four affect induction procedures. *Frontiers in Psychology*, *5*(689), 1–10. doi: 10.3389/fpsyg.2014.00689

INTRODUCTION

Embodied cognition is a concept that is revitalizing the interest in the role of the body in the processing of information. It can be defined as an effect where the sensorimotor states, morphology, or mental representations of the body play an important role in shaping the emotional and cognitive processes (Körner, Topolinski, & Strack, 2015).

For many years, research on the role of the body in information processing was scarce, almost nonexistent. However, in recent decades, theories of embodied cognition or embodied emotion are changing the understanding of information processing (Barsalou, 2008; Niedenthal, 2007), and one of the key components is that emotional and cognitive processes are strongly influenced by the bodily processes. In other words, it has been suggested that the body we have -the face, head, arms, torso, or legs- influences our sensory and motor experiences, contributing to building the bases for processing information (e.g., affective or cognitive processing). Thus, some authors have suggested that our facial expressions, body movements, or body posture may have a great influence on shaping our emotional and cognitive responses, and vice versa (Price, Peterson, & Harmon-Jones, 2012; Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015).

Specifically, extensive empirical evidence shows that expansive and upright postures (compared to contractive and stooped postures) have positive effects on several emotional and cognitive responses (Cuddy, Schultz, & Fosse, 2018), even in stressful situations (e.g., Nair, Sagar, Sollers, Consedine, & Broadbent, 2015). Nevertheless, there are still few studies in the scientific literature aimed at disentangling the cognitive and emotional effects of manipulating the body posture within the clinical therapeutic context. Consequently, there has been a call for more research in order to determine whether embodied cognition manipulations could be beneficial in altering cognitions and

emotions in evidence-based therapies, such as in cognitive-behavioral therapy (Folk et al., 2017).

Hence, the main objective of this dissertation is to analyze the influence of adopting expansive and upright (vs. contractive and stooped) postures on several cognitive and emotional responses in three laboratory experiments, which has clear clinical implications. To do so, a review of scientific literature to establish the state of art in the field of embodied cognition is carried out in chapter 1. Thus, a review is carried out of the theories of embodied cognition, the experimental studies performed in this field, and the inclusion of the body in psychopathological models and therapy so far, in order to identify the gap in the knowledge in this field and justify the need for this dissertation.

Subsequently, chapters 2, 3, and 4 present the three experimental studies in "article format", because they have been submitted to scientific journals indexed in the Journal Citation Report (JCR) of the Web of Knowledge (WOK) platform. One of them has already been published, and the other two are currently under review. Each chapter includes the abstract, theoretical justification, specific objectives and hypotheses, methodology, results, and discussion of each study.

Study 1 –entitled *"How posture may help in giving a speech: The role of posture expansiveness on an exposure task"* –, and Study 2 –entitled *"Expand your body when you look at yourself: The role of the posture in a mirror exposure task"*– are aimed at analyzing the role of expansive and upright postures (vs. contractive and stooped postures) during exposure to anxiety-provoking stimuli: an audience (in the case of study 1, in individuals with fear of public speaking) and the body (in the case of study 2, in individuals with body dissatisfaction). Briefly, both studies have the objective of testing the effect of the body posture as a strategy to induce emotions and thoughts that help to overcome stressful situations.

Study 3 –entitled *"Effect of an upright (vs. stooped) posture on interpretation bias, imagery, and emotions"*–, is aimed at investigating the effect of adopting an upright (vs. stooped) posture on two key processes associated with the maintenance of depression: interpretation bias and vividness of positive and negative mental imagery. Thus, this study is aimed at analyzing how an upright posture (associated with non-depression) compared to a stooped posture (associated with depression) induces the reduction in biased cognitive processes associated with the maintenance of this disorder in a sample of non-depressed people.

Finally, chapter 5 presents the general discussion, which summarizes the main conclusions of the three studies to provide an answer to the general objectives of this dissertation, as well as describing the limitations and future directions. Moreover, an attempt is made to explain how this knowledge derived from laboratory studies could be transferred to the clinical practice.

From our point of view, this dissertation sheds lights on a novel field that is still in its infancy but has strong potential. Thus, we consider that the research in this field is greatly needed in order to determine which body-related strategies may be effective at complementing and enhancing the outcomes of the currently established therapies.

References

Barsalou, L. W. (2008). Grounded Cognition. *Annual Review of Psychology*, *59*(1), 617–645. doi: 10.1146/annurev.psych.59.103006.093639

Cuddy, A. J. C., Schultz, S. J., & Fosse, N. E. (2018). P-Curving a More Comprehensive Body of Research on Postural Feedback Reveals Clear Evidential Value For Power-Posing Effects: Reply to Simmons and Simonsohn (2017). *Psychological Science*, 29(4), 656-666. doi: 10.1177/0956797617746749

Körner, A., Topolinski, S., & Strack, F. (2015). Routes to embodiment. *Frontiers in Psychology*, *6*(940), 1–10. doi: 10.3389/fpsyg.2015.00940

Nair, S., Sagar, M., Sollers, J., Consedine, N., & Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology, 34*(6), 632–641. doi: 10.1037/hea0000146

Niedenthal, P. M. (2007). Embodying emotion. *Science*, *316*(5827), 1002–1005. doi: 10.1126/science.1136930

Price, T. F., Peterson, C. K., & Harmon-Jones, E. (2012). The emotive neuroscience of embodiment. *Motivation and Emotion, 36*(1), 27–37. doi: 10.1007/s11031-011-9258-1

Winkielman, P., Niedenthal, P., Wielgosz, J., Eelen, J., & Kavanagh, L.C. (2015). Embodiment of cognition and emotion. In: M. Mikulincer, P.R. Shaver, E. Borgida, J.A. Bargh (Eds.). *APA handbooks in psychology. APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 151-175). Washington, DC, US: American Psychological Association.

CHAPTER 1. Background

1. Embodied cognition and emotion

1.1. Conceptualization

The conceptualization of embodied cognition and emotion varies across authors. Remarkable authors in this field, such as Niedenthal, Barsalou, Rig, and Krauth-Grube (2005), focused their definition on emphasizing the link between body and emotional processes, as well as the mechanism through which the body and emotions are related −the sensory reactivation or simulation−. Thus, they defined embodiment as the bodily states (e.g., postures, facial expressions) that arise when an emotional stimulus is perceived, and the later use of this emotional information when the emotional stimuli are absent (e.g., re-enacting perceptual, motor, and introspective states that were active during the corresponding experiences).

However, the present dissertation will adopt the definition by Körner, Topolinski and Strack (2015), which asserts that it is "an effect where the body, its sensorimotor state, its morphology, or its mental representation play an instrumental role in information processing" (p.1). It is a phenomenological definition that includes both cognitive and emotional processes and covers one of the main principles of the embodied cognition and emotion concept across definitions: processing information is an activity that is not separated from the body because the emotional and cognitive processes are strongly influenced by the body, including the body morphology, sensory, and motor systems (Glenberg, 2010; Glenberg, Witt, & Metcalfe, 2013). Thus, embodied cognition and emotion concepts suggest that cognitions and emotions are embodied, and consequently, information processing is not an activity that is separate from perception (e.g., vision, audition, proprioception), or action (e.g., movement).

1.2. Embodied cognition theories

One starting point of the study of the embodied cognition concept may be found in William James's theory. In his book, he explained the sequence of emotional experience and bodily changes as follows: "we feel sorry because we cry, angry because we strike, afraid because we tremble" (James, 1890, p. 449). Thus, more than a century ago, William James pointed out that the body was a crucial element in generating the emotional experience.

Laird and Lacasse (2014) concluded that this notion about the influence of facial expression (e.g., furrowed brow), expressive behaviors (e.g., crying), and visceral responses (e.g., increases in arousal) in emotional experience has been supported by broad empirical evidence. Moreover, they extend William James' theory, asserting that emotional experience arises from self-perceptions; or in other words, emotional experience arises from the perceptions of our actions and the social context in which they take place. In relation to this, they also determine that there are individual differences in the effect of bodily responses on emotional experiences because some individuals are more dependent on the perception of bodily states or personal cues (e.g., facial expressions, actions, etc.), whereas other individuals are more dependent on the perception of the social context or situational cues (e.g., norms about situations, social pressures, etc.).

However, other theories of cognitive and emotional processing have dominated in the past few decades. In traditional cognitive theories of information processing developed between the 1960s and 1980s (e.g., Anderson, 1983; Lang, 1979; Newel & Simon, 1976), the mind was considered an abstract information processor of symbolic representations, where the role of the body and the information provided by it was irrelevant. According to these theories, after experiencing an emotional state (e.g.,

happiness), the cognitive representation of the emotion is "des-embodied" in our mind; the sensory information is removed (e.g., the experience of feeling happy) and represented as a proposition (e.g., I feel happy) that is stored in memory in the form of abstract symbols. The so-called "sandwich model" dominated these classical theories (Hurley, 2001), where cognition was viewed as modular, without the necessity of taking into account the perceptual or motor processes. The mind was considered a kind of a sandwich where cognition was the filling placed between the perception (e.g., audition) and the action (e.g., movement). Consequently, the body was viewed as mere output that cannot interact with the "module" of cognition.

In contrast, in recent years, a radical shift has occurred in the understanding of how information is processed. A growing body of scientific literature emphasizes the influence of the body in shaping emotional and cognitive processes. These findings are framed within the theories of embodied cognition (e.g., Barsalou, 2008; Niedenthal, 2007), where the key component is that information processing "is influenced, informed, associated with, and sometimes dependent on perceptual, somatosensory, or motor resources" (Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015, p. 151). These theories consider that cognition or information processing may depend on bodily states and physical actions. Because of this, cognitive states may produce related bodily states, and bodily states can influence cognitive states (Barsalou, 2015). Thus, this approach suggests that the body -that we have face, head, arms, torso, or legs- influences our sensory and motor experiences, contributing to building the bases for processing information, such as affective processing (e.g., producing discrete emotions) or cognitive processing (e.g., producing specific attitudes or judgement).

The so-called grounded cognition theories, such as the theory of Perceptual Symbol Systems (Barsalou, 1999) or Situated Action or Cognition (Smith & Semin,

2004), extend the embodied cognition approach to a greater extent because they consider that cognition may be grounded in bodily states, but it may sometimes proceed independently from the bodily states and be grounded in several other ways. From this perspective, cognition may also rely on: (1) simulations, which use the brain's modality-specific systems, which constitute perception, action, and interoception, to reenact parts of the experience with the world, body, or mind (e.g., when we think of the concept of a chair, we do not represent a chair alone against an empty background; there is a simulation of how the image of the chair is, the action of sitting, the introspections of comfort and relaxation, etc.); and (2) situated actions, which use the social interactions or physical environment to situate cognition in a context −and inherently involve perception and action− (e.g., a chair may be simulated in a kitchen or in a theater) (Barsalou, 2008; 2015). Another grounded cognition theory is the Cognitive Linguistic Theory by Lakoff and Johnson (1980; 1999), which asserts that part of our language −the abstract concepts− is grounded metaphorically in embodied knowledge (e.g., abstract thought about morality is grounded in experiences of physical cleanliness). Thus, the use of metaphors indicates the way individuals represent and think about abstract concepts, and this way of representing and thinking results from the interaction between the body and the world.

Several approaches to embodied cognition have been described (Wilson, 2002), and the approach that is related to sensory simulation, or the use of sensory and motor resources in any cognitive process, is a useful approach to explain human cognition. However, some authors defend embodied cognition approaches, such as the Wilson and Golonka (2013) approach, that might be considered radical. These authors assert that much of the individual's mental life is modality based. In other words, they defend replacing amodal mental representations with modal representations in the understanding of information processing. However, these approaches have not been exempted from

criticism, as they are not able to explain some basic cognitive experiences in daily life (Goldinger, Papesh, Barnhart, Hansen, & Hout, 2016). As Winkielman et al. (2015) illustrate with examples, many abstract concepts, such as legal concepts (e.g., "copyright" or "negligence"), are non-perceptual, and individuals may understand them in symbolic terms. Even in emotions, when individuals have to think about the difference between anger and guilt, it is the conceptual knowledge (not perceptual knowledge) that allows them to know that anger involves another person's transgression, whereas guilt involves their own transgression. Thus, a more accepted approach is that the entire body provides sophisticated information that the mind uses sometimes (not always) to understand and interact with internal and external information, but the bodily states are only one of the factors that may contribute to information processing.

Glenberg et al. (2013) conclude that considering that the body is present when we are feeling, thinking, acting, experiencing emotion, socializing, and following cultural imperatives will lead to a more unified, comprehensive, and useful conceptual psychology framework. Indeed, Glenberg (2010) asserts that the principles of embodied cognition and grounded cognition can be applied to all fields of psychology, including clinical psychology.

1.3. Underlying mechanisms of embodiment: A parsimonious framework

The previous subsection summarizes different theories of embodied cognition that indicate the influence of bodily states on information processing. However, in order to simplify and clarify the underlying mechanisms of embodiment, this subsection presents a comprehensive conceptual framework proposed by Körner et al. (2015). Their framework proposes all the mechanisms through which bodily states influence information processing. Thus, they suggest three underlying automatic mechanisms for

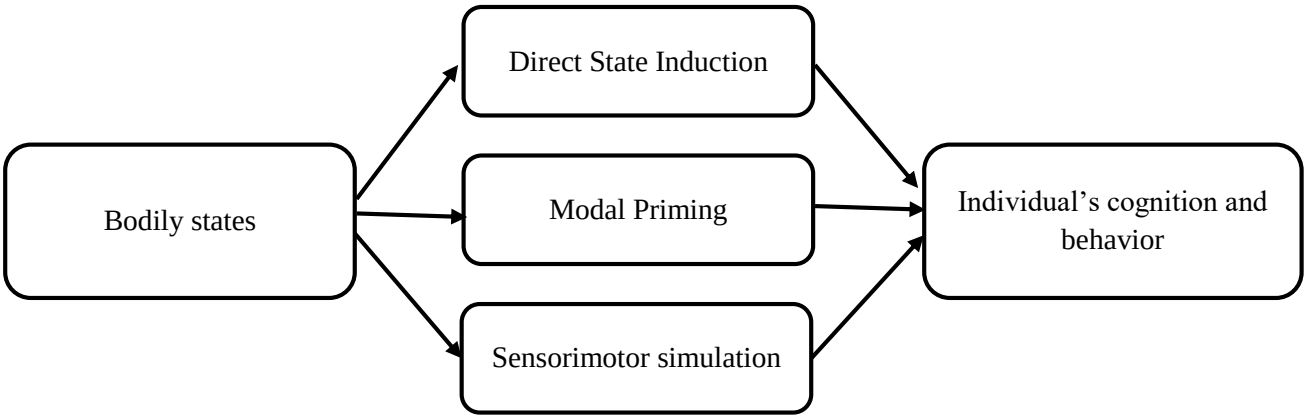
embodiment effects with different properties and consequences: direct state induction, modal priming, and sensory simulation. Each mechanism will be explained in the following points:

- *Direct state induction.* Bodily states directly alter the state of mind, feelings, or information processing (e.g., affective or non-affective feelings) of individuals, and they are not mediated by other cognitive mechanisms, such as attributions or conscious inferences. The activation of this global psychological state, mindset or emotion leads to broad affective, cognitive, and behavioral consequences. It has been proposed that if a state varies with body manipulation, and this variation mediates the effect of the body manipulation on the dependent variable, direct state induction would be the mechanism responsible for producing the embodiment effect. The authors suggest that the effects of the direct induction are independent from the context influences because they not rely on semantic and linguist associations (e.g., a smile leads to a happy state). Indeed, this direct state induction seems to be universal because the same effects have been found in different contexts (across cultures or languages). Thus, the connection between body and information processing seems to be phylogenetically shaped.
- *Modal priming.* Bodily states alter how available specific information or content is in the mind, such as abstract concepts. Thus, the manipulation of the body increases the accessibility to associated concepts (e.g., smile actives fun-related concepts) because it is presupposed that the representations of the concepts contain specific aspects of each motor and sensor modality. Moreover, bodily states and the abstract concepts are thought to be connected through conceptual metaphors (e.g., washing one's hands reduces guilt after a previous experience of transgression). In turn, the

activated semantic concepts may influence behavior responses. The test to analyze this mechanism consists of measuring the concept's accessibility (e.g., through lexical decision or word stem completion tasks). Thus, this mechanism would be responsible for the effect of the body manipulation on the dependent variable if the concepts mediating the effect are more activated (e.g., greater accessibility to positive valence words). Körner et al. (2015) point out that this mechanism seems to be idiosyncratic because it depends on cultural, linguistic, or biographical factors. Consequently, the associations may be changed through learning or experience.

- *Sensorimotor simulation.* Bodily states may have compatibility effects with concurrent automatic simulations that influence information processing, judgement, and behavior (e.g., automatic simulation of smiling is activated when humor is being evaluated). The automatic simulation is a partial reactivation of the action or the experienced sensation that uses the same neural regions, and it can also take place when the simulated bodily state, sensation, or action is absent. Moreover, this process can be blocked if other bodily states are activated during simulation. In fact, the authors propose that the fact that it is the mechanism responsible for the embodied effects on the dependent variable is demonstrated when a body manipulation congruent with the simulation facilitates the effect, and when a body manipulation incongruent with the simulation inhibits the effect. This mechanism has received considerable attention from different authors. For instance, Dijkstra and Post (2015) conducted an extensive review to demonstrate the role of sensorimotor simulation as the mechanism responsible for the embodied effects in different cognitive domains (e.g., autobiographical memory or facial mimicry).

Figure 1. Schematic representation of the three mechanisms of embodied cognition proposed by Körner et al. (2015).



Körner et al. (2015) suggest that the embodiment effects may be driven exclusively by one mechanism, but the more common pathway is that all the mechanisms operate jointly. For instance, Strack, Martin, and Stepper (1988) found that individuals who had been facilitated by smiling rated the cartoons as funnier than individuals whose smiles had been inhibited. According to the three explained mechanisms, their results may be explained by: (1) a direct state induction where smiling improved the mood (leading to cartoons being judged as funnier); (2) modal priming where the smiling activated fun-related concepts; or (3) sensorimotor simulation where subtle smiling is triggered when evaluating humor. Thus, they conclude that this framework consisting of three mechanisms may help to explain the embodiment effects found across studies.

2. Studies in the field of embodied cognition

A review of empirical evidence carried out by Price, Peterson, and Harmon-Jones (2012) supports the bidirectional relationship between certain manipulations of the body

and emotional and cognitive processes. Several studies in the scientific literature support this bidirectional relationship through the manipulation of facial expressions, arm movements, head movements, the way of walking, and body posture.

In the following subsection, a brief overview of the main studies carried out on facial expressions and body movements will be provided. However, as the focus of the present dissertation is the study of the psychological effects of the body posture, a more extensive subsection will be dedicated to summarizing the scientific evidence about the role of expansive and upright (vs. contractive and stooped) postures on emotional, cognitive, and behavioral processes.

2.1. Facial expressions

Regarding facial expressions, several studies have shown a relationship between the manipulation of facial expressions and emotional experience (e.g., Havas, Glenberg, Gutowski, Lucarelli, & Davidson, 2010; Niedenthal, Winkielman, Mondillon, & Vermeulen, 2009; Wollmer et al., 2012). These studies are based on the theory of William James (1980) and the facial feedback hypothesis of Laird (1974), and they usually consist of manipulating the facial expression of the individual with non-intrusive methods. For instance, the seminal study by Strack et al. (1988) found that when the muscle responsible for the smile in individuals was activated, these individuals rated the cartoons as funnier than those individuals who had been inhibited from smiling. The method used to manipulate the facial expression consisted of asking the individual to hold a pen between his/her teeth (to facilitate the smile) or between his/her lips (to inhibit the smile). Nevertheless, a recent meta-analysis of 17 pre-registered studies aimed at replicating this study found no significant differences between the “smile” and “pout” conditions (Wagenmakers et al., 2016).

2.2. Movements of head, arms, and the full-body

With regard to head movements, it has been observed that when individuals nod (moving their head up and down), in comparison with individuals who shake their heads (moving their heads from side to side), more positive attitudes towards neutral objects are produced (Tom, Pettersen, Lau, Burton, & Cook, 1991), as well as greater agreement with persuasive messages (Wells & Petty, 1980). Moreover, head movements have been found to have an influence on emotional processes. In the study by Rahona, Ruiz-Fernández, Rolke, Vázquez, and Hervás (2014), head movements moderated the effect of depressive symptoms on mood regulation, and higher initial levels of depressive symptoms were associated with greater persistence of a sad mood after mood regulation, but only in participants who performed lateral head movements.

Regarding body movement studies, arm movements have been found to be associated with approach or avoidance motivational responses. In a classic study, Cacioppo, Priester, and Berntson (1993) showed that when neutral stimuli (Chinese ideograms) were presented together with arm flexion (approach movement), individuals valued these ideograms more positively than when they were presented with arm extension (avoidance movement). Arm flexion seems to be associated with the acquisition of the desired stimulus, whereas arm extension is associated with the rejection of unwanted stimuli. Along these lines, Förster (2003) explored the effect of arm flexion and extension on food intake. In this study, individuals had to keep their arm extended or flexed while they were watching a television program with cookies in front of them. Results showed that, despite not receiving any instruction about the cookies, individuals who kept their arms extended ate fewer cookies than those who kept their arms flexed. Moreover, in a sample of alcoholic patients, arm movements were associated with approach and avoidance responses. Wiers, Eberl, Rinck, Becker, and Lindenmeyer (2011)

showed that arm flexion or extension affects cognitive biases toward alcohol in alcoholic patients. In this study, participants performed arm extension movements (avoidance action) in response to pictures of alcoholic drinks, and arm flexion movements (approach action) in response to pictures of non-alcoholic drinks. After four brief training sessions, participants showed an avoidance bias to alcohol and better treatment outcomes one year later. A meta-analysis by Laham, Kashima, Dix, and Wheeler (2015) revealed a significant small effect between the facilitation of arm flexion and extension movements, in response to positive and negative stimuli, respectively. However, this effect was moderated by several variables (e.g., type of emotional stimuli).

Other authors have studied the relationship between gait patterns and emotional and cognitive processes. Michalak et al. (2009) were pioneers in this field, revealing that a specific gait pattern (slumped posture, larger lateral swaying movements of the upper body, reduced walking speed, reduced arm swing, and reduced vertical movements) characterizes individuals in a dysphoric mood. In addition, Michalak, Rohde, and Troje, (2015) showed that changes in walking style (happier or depressed) affected the affective memory bias, and participants who walked in a happier pattern recalled more positive words. Along these lines, Peper and Lin (2012) found that participants who adopted slouched walking for three minutes experienced a decrease in their subjective energy, whereas participants who walked with skipping movements while looking upward increased their energy.

In sum, there is evidence of a reciprocal influence between body movements (arms, head, and whole body) and emotional, motivational, and cognitive processes.

2.3. Expansive and upright postures vs. Contractive and stooped postures

The link between body posture and emotional and cognitive states has been extensively studied. Specifically, the role of upright and expansive (vs. contractive and stooped) postures has received growing attention in research in the past decade. The combined introduction of the terms "stooped posture/pose", "slumped posture/pose", "expansive posture/pose", "upright posture/pose", and "power posture/pose" on the Web of Science database in the field of psychology led to 401 results, and 161 of the studies were published in the past 10 years. A more restrictive search, forcing the inclusion of the terms only in the title, led to 74 results, and 28 were published in the past decade.

The most relevant studies in the literature will be described in the following paragraphs. However, first it is important to clarify the differences between studies that manipulate the upright (vs. stooped) posture and those that manipulate the expansive (vs. contractive) posture. The experimental studies that manipulate the posture in an upright or stooped way emphasize elevating the chin, with the back and neck straight, and bringing the shoulders back (e.g., Michalak, Mischnat, & Teismann, 2014). In contrast, studies that manipulate the posture in an expansive or contractive way place the emphasis on the space taken up by the limbs of the body or the openness of the body (e.g., Carney, Cuddy, & Yap, 2010). Moreover, it is also important to clarify that there is no coincidence across studies about how long the specific posture is adopted (e.g., it may vary from 1 minute to 30 minutes); the moment when the posture is adopted (e.g., before and/or during the experimental task); whether the posture is adopted while individuals are seated or standing; or whether a cover story is used to hide the expected effects of the posture from the participants (Carney, Cuddy, & Yap, 2015). Nevertheless, the most common procedure is to adopt the posture for a short period of time, following the verbal instructions of the researcher, and hiding the real purpose of adopting a specific posture.

2.3.1. Studies on Upright vs. Stooped postures

One of the first studies to analyze the link between the upright (vs. stooped) posture and cognitive processing was conducted by Riskind and Gotay (1982). They found that the stooped posture (compared to an upright posture) negatively affected the time spent on a cognitive task and the sense of control over a task that consisted of solving geometric puzzles. Furthermore, and especially focusing the attention on memories, Riskind (1983) found that access to pleasant or unpleasant autobiographical events improved when individuals adopted a body posture and facial expression congruent with the emotional valence of the autobiographical event. Thus, individuals remembered more negative events when they were in the stooped posture and had a downcast facial expression, whereas they remembered more positive events when they were upright and smiling.

The study of the embodied effects of posture was not heavily reactivated until decades later. Thus, the study by Wilson and Peper (2004) assessed whether it was easier to generate positive and negative past events in an upright or stooped body posture. They found that positive past events were easier to recall in the upright posture. In a similar direction, Dijkstra, Kaschak, and Zwaan (2007) found that individuals remembered autobiographical events better if they were congruent with the body posture adopted when it was experienced. More recently, Tsai, Peper, and Lin (2016) recorded the electroencephalogram patterns of individuals during the recall of positive and negative events while they were maintaining an upright or stooped posture. The authors reported that evoking positive events required more effort or arousal (e.g., increase in high-frequency oscillatory activities) while in a stooped posture (compared to an upright posture). Furthermore, a study with a clinical sample of patients diagnosed with major depression showed that the adopted posture had an influence on self-referent words on an experimental task. Individuals were asked to create a visual scene for positive (e.g.,

enjoyable) and negative (e.g., exhaustion) words by imagining themselves in connection with the presented word (e.g., a scene in which they felt exhaustion) while they were maintaining an upright or stooped posture. After a distraction task, participants seated in a stooped posture recalled more negative words, whereas participants seated in an upright posture showed a balanced recall of positive and negative words (Michalak et al., 2014).

Leaving memories aside and focusing the attention on the link between posture and self-relevant thoughts, Briñol, Petty and Wagner (2009) analyzed the relationship between posture and self-attributes, asking the participants to write the best and worst qualities of their potential professional success while they were in an upright and stooped posture. They found that participants seated in an upright posture showed more confidence in their positive self-attributions. Along the same lines, Oosterwijk, Rotteveel, Fischer and Hess (2009) explored the effect of self-attribution on changes in body posture. The authors analyzed the body posture of individuals while they were generating words of pride and disappointment for one minute, and they observed that individuals spontaneously adopted a stooped posture while they were generating words of disappointment.

Regarding the effect of the upright posture on emotional processes, Wilkes, Kydd, Sagar, and Broadbent (2017) found that upright (vs. the usual) posture increased positive affect, reduced fatigue, and decreased self-focus on a speech task in people with mild to moderate depression. In the same direction, Veenstra, Schneider, and Koole (2016) found that posture can play an important role in recovery from negative mood. Participants who adopted a stooped (vs. upright) posture recovered less from their negative mood after negative mood induction. Furthermore, this finding was maintained, regardless of whether participants performed cognitive reappraisal or not.

Moreover, in a study related to the effect of posture on cognitive, emotional and behavioral responses in a stressful situation, the results showed that participants in an upright (vs. contractive) posture showed: higher self-esteem, more arousal, more positive mood, more positive spoken emotion words and less negative spoken emotion words, and more spoken words in general, during a stressful speech task (Nair, Sagar, Sollers, Consedine, & Broadbent, 2015).

Furthermore, it is important to highlight that the adopted posture can interact with other variables, depending on the context, resulting in different outcomes. Kozak, Roberts, and Patterson (2014) manipulated objectification (by making the women wear a form-fitting tank top or a loose sweatshirt) or the status (by making the women sit on a throne or a child's chair) while women were upright or stooped. They found that the women seated upright reported more positive mood (e.g., happy, proud) than women seated stooped. However, the manipulation of the objectification and status or power generated a different impact on performance (specifically, on a math cognitive task). For instance, women seated upright in a child's chair (low status or power) who wore a sweatshirt (low objectification) performed the task better.

Finally, it is important to pay attention to the differential effects that the posture may have depending on gender. Roberts and Arefi-Afshar (2007) found that the effects of the posture on receiving feedback about success was different for men and women in terms of performance (completing a math task), mood, and performance self-ratings. Men's responses coincide with the initial hypothesis of the authors (e.g., they performed better and had more positive self-ratings when they adopted an upright posture). In contrast, in the case of women, after adopting an upright (vs. stooped) posture, they performed worse and rated their mood and performance more negatively after the success feedback. The authors gave two explanations for these results that were related to the

meaning of the upright posture. On the one hand, they proposed that the social meaning the upright posture conveys may be involved in the differential results (Weisfeld & Beresford, 1982). As the upright posture may be a signal of dominance and social success, and women may have less social dominance than men in their real lives, in this experiment women had more difficulties in accessing the proprioceptive signals of the posture because it was not their "natural" posture. On the other hand, they proposed the objectification theory and the consequences derived from the social meaning of women's bodies (Fredrickson & Roberts, 1997). The authors proposed that the upright posture, where the sternum and breasts are spotlighted, could induce self-objectification, disrupting performance and positive emotions such as pride.

2.3.2. Studies on Expansive vs. Contractive postures

The starting point of the study of the expansive (vs. contractive) posture in psychological processing may be found in the Carney et al. (2010) study. In this study, adopting an expansive (vs. contractive) posture for two minutes was associated with increased risk-taking behavior on a laboratory task. Moreover, changes associated with increased feelings of power were found, as well as hormonal changes associated with more dominance (increased testosterone) and less stress (reduced cortisol). Years later, the same authors conducted another study where participants had to adopt an expansive (vs. contractive) posture before a simulated –but stressful– job interview. Results showed that participants who adopted an expansive posture had better nonverbal behavior (e.g., more confident) that led to better overall performance during the interview (rated by external observers) (Cuddy, Wilmuth, Yap, & Carney, 2015).

The role of the adopted posture in other behavioral variables, such as eating behaviors, has also been studied. In the study carried out by Allen, Gervais, and Smith

(2013) in a sample of women with high body dissatisfaction, they found that the adoption of an expansive body posture attenuated the relationship between women's preoccupation about their body image and their restrictive eating behavior. That is, women who were seated in an expansive (vs. contractive) posture showed less restrictive eating behavior on a laboratory task.

Nevertheless, the effect of expansive (vs. contractive) postures on cognitive, emotional, and behavioral responses has been controversial. For instance, recent replications of the study by Carney et al. (2010) did not find the same effects on the hormonal response (cortisol and testosterone), risk tolerance, or self-reported feelings of "power" (Garrison, Tang, & Schmeichel, 2016; Ranehill et al., 2015). Indeed, Simmons and Simonsohn (2017) concluded in a *p*-curve analysis that there is a lack of empirical support for the effects of the expansive posture (also called "power poses"), and they concluded that "the existing evidence is too weak to justify a search for moderators or to advocate for people to engage in power posing to better their lives" (pp. 690-691). However, these results have been criticized because the authors grouped several dependent variables (e.g., physiological, cognitive, and behavioral effects) in one unique outcome, and they also used the 34 studies from a narrative review from the study by Carney et al. (2015) (rather than a systematic review performed by themselves). Moreover, a recent Bayesian meta-analysis of preregistered studies showed the connection between expansive postures and increases in self-reported felt power (Gronau et al., 2017). In fact, a recent *p*-curve analysis conducted by Cuddy, Schultz, and Fosse (2018), based on a systematic review of 55 studies related to the uprightness and expansiveness of the posture, revealed strong support for postural effects on feelings of power, and even stronger effects on emotions, affect, and self-evaluations.

Nevertheless, a recent study showed that other postures seems to be more powerful in changing specific feelings. For instance, de Zavala, Lantos, and Bowden (2017) compared open and closed body yoga postures (e.g., emphasizing the lifting of the spine and the expansion of the chest) and the expansive and contractive postures used in the study conducted by Carney et al. (2010). They found that yoga postures (compared to "power poses" or expansive postures) improved self-esteem by increasing the subjective sense of energy and empowerment.

2.3.3. Summary

It can be concluded that there is strong evidence about the positive effects of expansive and upright (vs. contractive and stooped) postures in cognitive, emotional, and behavioral processes. However, there is a lack of evidence about how the therapist can use the body posture during therapy. For instance, some unanswered questions are: what body posture is able to change a specific outcome, what is the best moment to use it, and how long should it be used. Moreover, there is still a more basic question to be answered: Does the upright and expansive posture help to enhance outcomes in therapy?

3. The body in clinical psychology

3.1. The inclusion of the body in theoretical models of mental disorders

The inclusion of the role of the body in the psychopathological models of mental disorders has been largely neglected. In this dissertation, two models are highlighted that emphasize the importance of the bodily processes in the symptomatology of mental disorders −mainly to explain depression−. These models are the Interacting Cognitive Subsystems approach (Barnard & Teasdale, 1991; Teasdale & Barnard, 1993) and the

Metaphor Simulation Model (Lindeman & Abramson, 2008). They will be explained in the following subsections.

3.1.1. The Interacting Cognitive Subsystem

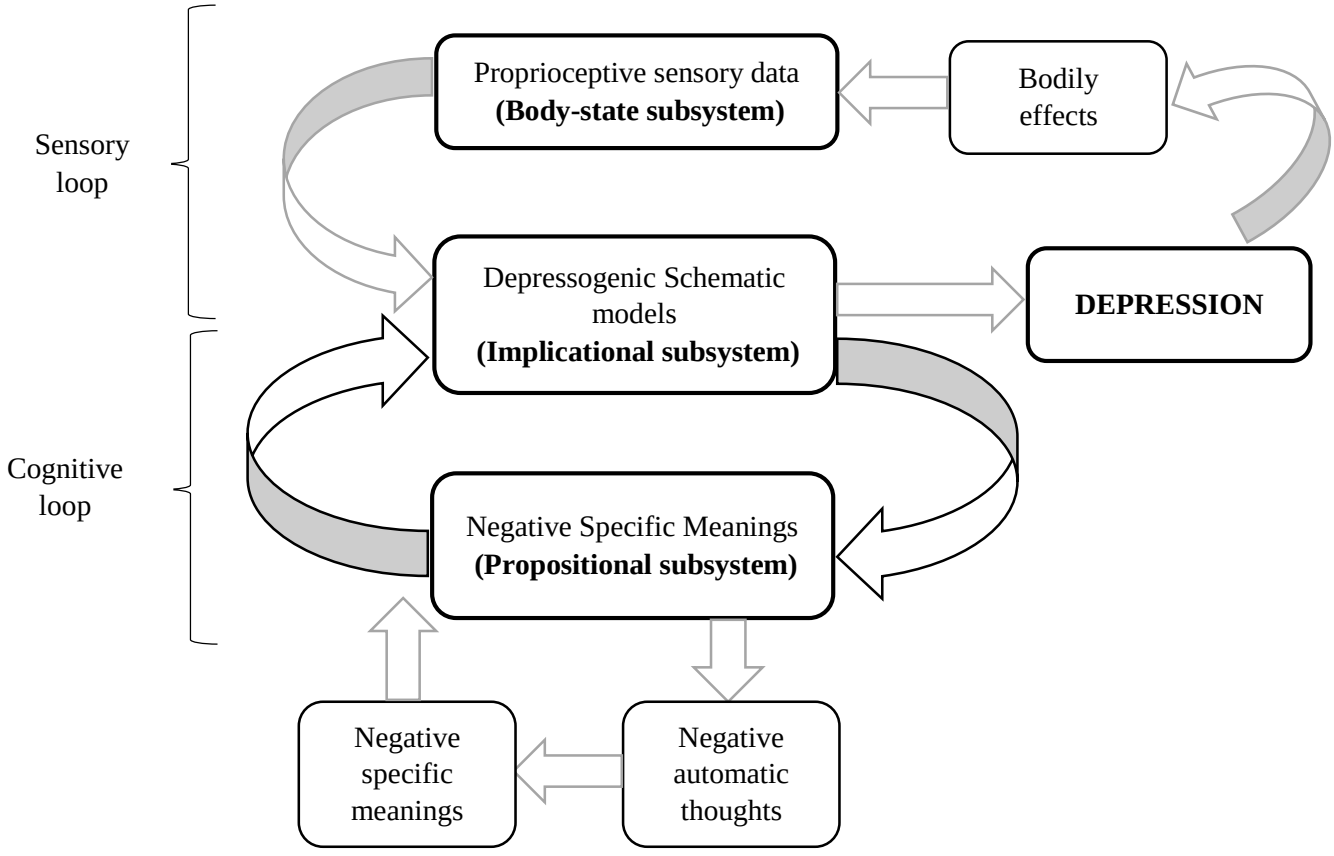
The Interacting Cognitive Subsystems (Barnard & Teasdale, 1991; Teasdale & Barnard, 1993) is a theoretical comprehensive model of the organization and function of the resources underlying individuals' cognition. It proposes that there are nine cognitive subsystems specialized in handling different information: sensory subsystems for gathering information (acoustic, visual, and body state subsystem), central subsystems for dealing with descriptions and meanings (morphonolexical, propositional, implicational, and object subsystem), and the effector subsystems for the control of behavior (articulatory and limb subsystem).

One subsystem that is highly relevant in producing emotional states is the "implicational subsystem". It is directly linked to emotion and encodes schematic models that process more implicit, generic, and holistic levels of meanings (e.g., global negative view of self, hopeless view of the future). It integrates information from different sources of information: the "propositional subsystem" (which encodes specific, explicit, factual, or conceptual meanings; e.g., whether one has recently failed) and the "body state subsystem" (which encodes sensory inputs from taste, smell, touch, pain, and proprioception; e.g., whether the posture was upright or stooped, or the expression was frowning or smiling).

According to this approach, depressed states arise when depressogenic schematic models in the implicational subsystem are produced due to negative specific propositional meanings and negative body states. For instance, individuals will feel hopeless if their thoughts have a negative specific meaning (e.g., "I have failed the exam") and their

proprioceptive information from the body is also negative (e.g., a stooped and contractive posture) because both kinds of information contribute to the production of a depressogenic schematic model (e.g., global negative view of self). Moreover, the model theorizes that depression may be maintained if a depressive interlock configuration is derived from the sensory loop (the reciprocal cycles between the proprioceptive sensory data and the depressogenic schematic models) and the cognitive loop (the reciprocal cycles between the negative specific meaning and the depressogenic schematic models, in which the specific meaning may be experienced as streams of "negative automatic thoughts" that, at the same time, may create other specific negative meanings) (see Figure 2).

Figure 2. Schematic representation of the internal maintenance of depression according to the Interacting Cognitive Subsystems (Adapted from Teasdale et al., 1995)



Teasdale, Segal, and Williams (1995) identify several strategies through which the establishment of the interlock between subsystems could be prevented. One of them is related to the manipulation of the body, which consists of promoting the synthesis of alternative schematic models through the change in body inputs (e.g., changing a stooped posture to an upright posture may increase the probability of considering the depressogenic schemas of hopelessness to be simple "mental states", and not the "reflection of the reality"). For instance, the therapeutic effects of mindfulness practice – that is, focusing attention in an intentional way on the experience of the present moment, including bodily sensations, thoughts or feelings, and the environment, with an attitude of acceptance and without judging (Bishop et al., 2004)– have been explained through this strategy of interlock disruption. According to Teasdale et al. (1995), the erect and dignified posture, which is adopted during the exercise of mindfulness, creates patterns of proprioceptive information that help to view depressogenic mental representations as simple "representations", and not as "realities". Thus, the adoption of the upright posture (compared to the stooped posture, which is characteristic of individuals with depression) disrupts the sensory loop because the proprioceptive information derived from the upright posture does not encode imminent threat or personal global worthlessness in the implicational subsystem.

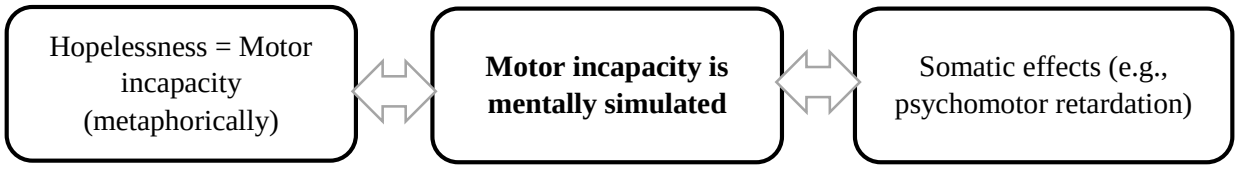
3.1.2. The Metaphor Simulation Model

The Metaphor Simulation Model (Lindeman & Abramson, 2008) is a theoretical model aimed at describing the causal mechanisms or pathways that link the cognitive symptoms of depression –the hopelessness or the belief that one is incapable of altering events– and the somatic symptoms of depression –the psychomotor retardation that involves slowed motor movements, stooped posture, or attenuated facial expressions–.

This model is rooted in embodied cognition, conceptual metaphors, and mental imagery, and it suggests that the abstract concept of hopelessness leads to psychomotor retardation through the metaphorical simulation of the sensorimotor experience of motor incapacity. The authors consider that this process is automatic and unconscious, and the causal chain is bidirectional (e.g., the motor retardation of endogenous origin may influence thoughts of hopelessness).

The process would be as follows: (1) hopelessness is conceptualized metaphorically as motor incapacity; (2) the sensorimotor experience of motor incapacity is mentally simulated or recreated; and (3) the simulation produces the corresponding peripheral somatic effects –that is, low energy and psychomotor retardation–. Consequently, mental simulation is responsible for the low energy and psychomotor retardation present in hopelessness depression (see Figure 3).

Figure 3. Representation of Lindeman and Abramson (2008)'s model.



Lindeman and Abramson (2008) pointed out that this model has clinical implications, such as assisting in identifying cognitions through their manifestations in central and peripheral activity (e.g., through metaphorical expressions, gestures, or bodily states) because these manifestations may be considered simulations of metaphoric cognition. Moreover, this model can help to alleviate the cognitive symptoms (e.g., hopelessness and negative cognitions) through the mental simulation of motor capacity

(e.g., imagining motor movements and physical energy) or body experiences (e.g., through exercise) because these actions obstruct the mental simulation of motor incapacity, counteracting the individual's concept of him/herself as psychologically incapable and reducing thoughts of hopelessness. One prediction of this model is that these strategies would improve mood, thus facilitating cognitive change in cognitive behavioral therapy.

3.1.3. Summary

This section summarizes two models with important clinical implications that have included the role of the body in explanatory psychopathological models of mental disorders, mainly addressing depression.

3.2. The inclusion of the body in therapy

3.2.1. Evidence-based therapies that include the body

Few evidence-based therapies have included the bodily processes in therapy. However, there are two evidence-based therapies that pay special attention to the body during the therapy. These therapies are the Mindfulness-Based Treatments for depression and the Dialectical Behavioral Therapy for borderline personality disorder.

With regard to the mindfulness-based treatment approaches, Michalak, Burg, and Heidenreich (2012) highlighted that the body is a key component, as in Mindfulness-Based Cognitive Therapy (Segal, Williams, & Teasdale, 2002) –an effective depression prevention therapy for individuals with a history of recurrent depression that has been recommended by the National Institute for Clinical Excellence (NICE, 2009)–. In mindfulness approaches, one fundamental characteristic of the exercises is their focus on training body awareness (e.g., practicing awareness of breathing while the individual is

fully body aware). In this regard, Michalak et al. (2012) suggest that the bodily processes may be involved in the action's mechanisms from the mindfulness therapy approaches. For instance, mindfulness exercises may lead to being aware of the interplay between the body and the emotional processes, allowing dysfunctional bodily processes to change to other more beneficial ones. Nevertheless, these authors conclude that is too early to draw robust conclusions, and they call for more research in order to confirm the role of the body in these therapy approaches.

Other therapy that includes body-related skills is Dialectical Behavior Therapy, developed by Marsha Linehan (1993), which has been recommended by the NICE guidelines for individuals diagnosed with borderline personality disorder (NICE, 2009). One of its main therapeutic objectives is to teach skills in tolerating distress and regulating emotions; and to do so, several embodied cognition and emotion skills are used in therapy (Linehan, 2015). For instance, in the skill called "Opposite Action", individuals are encouraged to act in the opposite way to their current emotion, in terms of facial expressions, actions, or posture, until the unpleasant emotion decreases. This skill is aimed at changing or reducing unwanted emotion when the emotion does not fit the facts (e.g., when the emotion is not effective for meeting goals or is not justified by the situation). Other skills used to accept reality through the body are the "Half-Smile" and "Willing Hands". In the "Half-Smile" skill, individuals are encouraged to adopt a relaxed, serene, and accepting smile in order to generate a serene mood; whereas in the "Willing Hands" skill, individuals should adopt an open posture with relaxed fingers and their palms facing the ceiling and unclenched. Indeed, the therapist introduced the patients to embodied cognition concepts by explaining that emotions are partially controlled by the facial expression, or that clenched hands are indicative of anger (which is often opposed to accepting reality).

As can be seen, the therapeutic strategies involving the body are still limited in evidence-based therapies. Moreover, research in this field is scarce. Most of the embodied cognition studies have been carried out in the field of basic psychology. However, given the enormous potential of the body in changing cognitions and emotions, more embodied cognition research applied to the field of clinical psychology is necessary.

3.2.2. Calling for research to include the body in therapy

Several authors have started to defend the need to determine which body manipulations could be beneficial to modify cognitions and emotions in therapy (Folk et al., 2017). Indeed, these authors have proposed the embodied cognition approach as a field that has clear clinical applications as a "wise intervention" –a type of intervention that Walton (2014) outlined as a brief and precise intervention, driven by research and theory, where the main objective is to change a specific psychological process that contributes to some problems–.

Only a handful of experimental studies have analyzed the effect of manipulating the body as an adjunctive strategy in cognitive-behavior therapy (CBT). More specifically, in the case of body posture manipulations, one study has analyzed the efficacy of adopting an expansive posture (vs. submissive/contractive posture vs. resting posture) as a strategy to enhance exposure therapy in individuals diagnosed with social anxiety disorder (Davis et al., 2017). In this randomized controlled trial, individuals with social anxiety disorders participated in three exposure sessions where the posture manipulation was carried out before the exposure for a short period of time. Changes in testosterone and cortisol were analyzed, as well as the ratings of fear –measured on a scale ranging from 0 to 100–. Although the exposure therapy resulted in decreased social anxiety symptom severity in all the conditions one week later, the hormonal levels of

testosterone and cortisol, the ratings of fear during each exposure session, and the social anxiety symptoms were not significantly different across conditions. Nevertheless, it is a study that leaves several questions open that should be tested (e.g., What effect does the posture have on other therapeutic outcomes? What posture should be adopted during the exposure? Does the emphasis on the position of the back change the outcomes?)

In this regard, Folk et al. (2017) conclude that "the use of such embodied cognition techniques is still in its relative infancy, and in future years may become more sophisticated and systematic in using body manipulations in CBT or other forms of psychotherapy" (p. 10). Thus, these authors propose the use of embodied cognition techniques as adjunctive skills for the current established evidence-based therapies.

Along the same lines, Winkielman et al. (2015) point out that direct applications of embodied cognition and emotion theories may contribute to addressing mood disorders. For instance, manipulating the gait, facial expression (e.g., inhibiting a sad expression) or posture (e.g., holding an upright) of patients may counteract depression symptoms (e.g., counteract feelings of self-efficacy, priming positive memories, etc.).

3.2.3. Towards a new therapy model: Including bottom-up strategies in a traditional therapy based on top-down strategies

The CBT assumes that thoughts and beliefs play a substantial role in the experience of emotion and behavior, and in general terms, the treatment is aimed at producing cognitive change through the modification of the individual's thinking and belief system in order to achieve an enduring emotional and behavioral change (e.g., Beck, 2011). To reduce dysfunctional thoughts and beliefs, it uses several strategies during therapy, such as seeking verbal expression for an experience (to provide an interpretation and a re-interpretation), identifying and examining beliefs, or elaborating problem solutions and

plans (Hauke, Lohr, & Pietrzak, 2017). These strategies are mostly based on top-down processing, which may be defined as a "slow, deliberate, explicit and strategic form of rational processing that uses rule-based knowledge to guide the information processing system" (Clark & Beck, 2010, pp. 418).

The embodied cognition approach opens up the possibility of new forms of treatment in CBT because it can extend the therapeutic models of psychology that are derived from the traditional amodal models of cognition. From this perspective, for instance, cognitions may be enhanced by the participation of the body and the activation of the sensory and motor system. Thus, some authors propose integrating bottom-up strategies in therapy (Hauke et al., 2017). Bottom-up processing may be defined as a "primitive automatic, effortless, implicit and preconscious processing of information dominated by the salient features of a relevant stimulus or situational cues and their schematic associations" (Clark & Beck, 2010, pp. 418). Thus, bottom-up strategies would involve several aspects, such as placing the focus on sensory perceptions, physical perceptions, or body movements; observing the body to access the roots of emotional experience and pre-lingual processes; or inducing sensorimotor inputs (e.g., moving, tensing, etc.) to make automatic processes conscious (Hauke et al., 2017).

In this way, the study by Zhang, Yu, and Barrett (2014) suggests that embodied manipulations could be an adequate method to induce unpleasant or pleasant affects. They compared the efficacy of four affect induction procedures (recalling an affectively salient event while listening to music; guided imagery of a fictitious scenario; viewing images while listening to music; and making affective facial expressions, body postures and vocal expressions), and they concluded that all the mood induction procedures were successful in inducing pleasant or unpleasant affect. In this regard, the results of this study point out

that embodiment techniques, which are easy to use and do not require any equipment, could be used to induce some emotional or cognitive processes by modifying body states.

In addition to being considered a mood induction instrument, the body has been considered an emotion regulation strategy. According to Koole (2009), an emotion regulation strategy may be defined as the specific approach that individuals take in managing their emotions. This author conducted an integrative review to organize the emotion-regulation strategies, concluding that the body –along with attention and knowledge– is one of the emotion-generating systems that should be target as an emotion regulation strategy. He also distinguishes the different functions of emotion regulation, which consist of promoting the satisfaction of hedonic needs (need-oriented strategies), supporting goal pursuit (goal-oriented strategies), and maintaining the overall functioning of the personality system (person-oriented emotion regulation). In the case of the body, the author identifies several emotion-regulation strategies related to the body and concludes that some cognitive strategies are not more effective than bodily strategies in specific domains, such as in the case of person-oriented emotion regulation (e.g., using controlled breathing and progressive muscle relaxation to down-regulate stress).

In an attempt to explain the dynamic nature of emotion regulation and include the body in this process to a greater extent, Koole and Veenstra (2015) developed an approach that proposes that the emotion regulation process occurs not only inside individuals' heads. They adopt a situated cognition approach, suggesting that emotion regulation emerges from the interplay between individuals and the affordances of the situation (or in other words, the transactions that are possible between individuals and the situation), and they identify affordances that stem from the body, the tools (e.g., external instruments to improve the mood), and other people. Thus, a valuable emotion-regulatory affordance arises from the individual's own body. The authors assume that emotions are embodied,

and consequently, the body can contribute to successfully regulating emotions. It has been pointed out that changing emotional expressions (e.g., body posture) may be an effective strategy to implicitly regulate emotional states. The term implicit emotion regulation may be defined as "any process that operates without the need for conscious supervision or explicit intentions, and which is aimed at modifying the quality, intensity, or duration of an emotional response" (Koole & Rothermund, 2011, pp. 390). Nevertheless, Koole and Veenstra (2015) conclude that bodily affordances may also intervene in more effortful forms of emotion regulation. In short, these authors assume that bottom-up processes of emotion regulation (e.g., trusting in their immediate sensorimotor interactions with the environment to regulate their emotions) can complement the top-down processes associated with the traditional view of emotional regulation (e.g., constructing explicit and linguistically verbalizable goals guided by mental representations to regulate the emotions).

3.2.4. Summary

In conclusion, strategies derived from embodied cognition approaches are becoming potential tools to be used during therapy. The bodily processes may act as activators of cognitions, mood inducers, or emotion regulation strategies that help to enhance the outcomes in therapy. Nevertheless, this field is still in its infancy, and more research is needed to disentangle the functions that the bodily process may have as adjuvant strategies for evidence-based therapies.

4. Outline of this dissertation

As shown in previous sections, the body is a source of information and an important substrate where cognitive and emotional processes develop. Specifically, the adopted

body posture is an influential factor in processing cognitive and emotional information. However, there are still few studies in the scientific literature aimed at disentangling the effects of manipulating the body posture on cognitive and emotional responses within the clinical psychology context. Therefore, the purpose of this dissertation is to analyze the influence of adopting expansive and upright postures (vs. contractive and stooped postures) on several cognitive and emotional responses in three experiments. Despite testing these effects only in a laboratory context, the final objective of the studies included in this dissertation is to enrich the current CBT strategies through the inclusion of the body posture. Therefore, the three experiments have a clear clinical orientation.

The **general objectives** of this dissertation are:

1) To analyze the effects of adopting expansive and upright (vs. contractive and stooped) postures before and during the exposure to different anxiety-provoking stimuli (associated with social anxiety and eating disorders) on cognitive and emotional processes.

2) To investigate the effects of adopting an upright (vs. stooped) posture on changing two mechanisms associated with the maintenance of depression (cognitive bias interpretation and abnormalities in mental imagery) and related emotions.

3) To explore the possible moderator and mediator variables of these effects in order to answer *for whom* and *how* the effects of posture on different outcomes are produced.

4) To clarify the possible clinical applications of the manipulation of the body posture in therapy.

Study 1 and Study 2 are aimed at analyzing the role of expansive and upright postures (vs. contractive and stooped postures) during the exposure to anxiety-provoking

stimuli: to an audience (in the case of study 1, in individuals with fear of public speaking) and the body (in the case of study 2, in individuals with body dissatisfaction). **Study 1** is presented in chapter 2, entitled *"How posture may help in giving a speech: The role of posture expansiveness on an exposure task".* It is designed to analyze the influence of body expansiveness in the exposure to an anxiety-provoking situation in women with fear of public speaking. It sheds light on the understudied relationship between posture and social anxiety disorders because the main objective of the present study is to analyze what body posture should be adopted before and during the exposure technique to achieve positive therapeutic outcomes. In agreement with embodied cognition and emotion theories, this study points out that the adoption of an expansive (vs. contractive) posture seems to be a promising therapeutic strategy that should continue to be explored, due to its positive effects on the cognitive and affective responses before the exposure. This study provides important insight into the best moment to manipulate the body posture that was introduced later in the experimental design of study 2.

Study 2 is presented in chapter 3, entitled *"Expand your body when you look at yourself: The role of the posture in a mirror exposure task".* It is aimed at analyzing the effect of adopting an expansive and upright (vs. contractive and stooped) posture before a mirror exposure task on body-related emotions and cognitions in women with body dissatisfaction. So far, no studies have analyzed what body posture should be adopted in the mirror exposure task in order to maximize its effectiveness. However, in line with embodied cognition theories, this study points out that the adoption of an expansive (vs. contractive) posture seems to be a promising therapeutic strategy that should continue to be explored, due to its positive effects on the cognitive and emotional responses to exposure to the person's own body.

Chapter 4 presents **study 3**, entitled *"Effect of an upright (vs. stooped) posture on interpretation bias, imagery, and emotions"*. The main objective of this study was to investigate the effect of adopting an upright (vs. stooped) posture on two key processes associated with the maintenance of depression: interpretation bias and vividness of positive and negative mental imagery. Moreover, it is also showed the effect of posture on depression-related emotions, as well as the interplay among interpretation bias, imagery vividness, and emotions. This study has theoretical and clinical implications that point to the need to continue to explore the body posture in depression.

In summary, studies 1 and 2 have the objective of testing the effect of the body posture as a strategy to induce emotions and thoughts that help to overcome stressful situations. In contrast, study 3 has the objective of testing how a body posture associated with non-depression (vs. depression) −upright posture (vs. stooped posture), respectively− induces the softening of cognitive processes associated with the maintenance of this disorder in a sample of non-depressed people.

Finally, chapter 5 presents the **general discussion**, including a summary of the main conclusions of the three studies responding to the general objectives of this dissertation, as well as the strengths, limitations, and future directions.

5. References

Allen, J., Gervais, S. J., & Smith, J. L. (2013). Sit Big to Eat Big: The Interaction of Body Posture and Body Concern on Restrained Eating. *Psychology of Women Quarterly*, *37*(3), 325–336. doi: 10.1177/0361684313476477

Anderson, J. R. (1983). *The architecture of cognition.* Cambridge, MA: Harvard University Press.

Barnard, P. J., & Teasdale, J. D. (1991). Interacting cognitive subsystems: A systemic approach to cognitive-affective interaction and change. *Cognition & Emotion, 5*(1), 1-39. doi: 10.1080/02699939108411021

Barsalou, L. W. (1999). Perceptions of perceptual symbols. *Behavioral and brain sciences, 22*(4), 637-660. doi: 10.1017/S0140525X99532147

Barsalou, L. W. (2008). Grounded Cognition. *Annual Review of Psychology, 59*(1), 617–645. doi: 10.1146/annurev.psych.59.103006.093639

Barsalou, L. W. (2015). Situated Conceptualization : Theory and Application. In Y. Coello & M. H. Fischer (Eds.), *Foundations of embodied cognition*. East Sussex, UK: Psychology Press.

Beck, J. S. (2011). *Cognitive Behavior Therapy: Basics and Beyond*. New York, NY: The Guilford Press.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., … Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*(3), 230–241. doi: 10.1093/clipsy/bph077

Briñol, P., Petty, R. E., & Wagner, B. (2009). Body posture effects on self-evaluation: A self-validation approach. *European Journal of Social Psychology, 39*(6), 1053-1064. doi: 10.1002/ejsp.607

Cacioppo, J. T., Priester, J. R., & Berntson, G. G. (1993). Rudimentary determinants of attitudes: II. Arm flexion and extension have differential effects on attitudes. *Journal of Personality and Social Psychology, 65*(1), 5–17. doi: 10.1037/0022-3514.65.1.5

Carney, D. R., Cuddy, A. J. C., & Yap, A. J. (2010). Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science, 21*(10), 1363–1368. doi: 10.1177/0956797610383437

Carney, D. R., Cuddy, A. J. C., & Yap, A. J. (2015). Review and Summary of Research on the Embodied Effects of Expansive (vs. Contractive) Nonverbal Displays. *Psychological Science, 26*(5), 657–663. doi: 10.1177/0956797614566855

Clark, D. A., & Beck, A. T. (2010). Cognitive theory and therapy of anxiety and depression: Convergence with neurobiological findings. *Trends in Cognitive Sciences, 14*(9), 418–424. doi: 10.1016/j.tics.2010.06.007

Cuddy, A. J. C., Schultz, S. J., & Fosse, N. E. (2018). P-Curving a More Comprehensive Body of Research on Postural Feedback Reveals Clear Evidential Value For Power-Posing Effects: Reply to Simmons and Simonsohn (2017). *Psychological Science, 29*(4), 656-666. doi: 10.1177/0956797617746749

Cuddy, A. J. C., Wilmuth, C. A., Yap, A. J., & Carney, D. R. (2015). Preparatory power posing affects nonverbal presence and job interview performance. *Journal of Applied Psychology, 100*(4), 1286–1295. doi: 10.1037/a0038543

Davis, M. L., Papini, S., Rosenfield, D., Roelofs, K., Kolb, S., Powers, M. B., & Smits, J. A. J. (2017). A randomized controlled study of power posing before public speaking exposure for social anxiety disorder: No evidence for augmentative effects. *Journal of Anxiety Disorders, 52*(Dec), 1–7. doi: 10.1016/j.janxdis.2017.09.004

de Zavala, A. G., Lantos, D., & Bowden, D. (2017). Yoga poses increase subjective energy and state self-esteem in comparison to "power poses." *Frontiers in Psychology*, *8*(752), 1–12. doi: 10.3389/fpsyg.2017.00752

Dijkstra, K., Kaschak, M. P., & Zwaan, R. A. (2007). Body posture facilitates retrieval of autobiographical memories. *Cognition*, *102*(1), 139–149. doi: 10.1016/j.cognition.2005.12.009

Dijkstra, K., & Post, L. (2015). Mechanisms of embodiment. *Frontiers in Psychology*, *6*(1525), 1–11. doi: 10.3389/fpsyg.2015.01525

Förster, J. (2003). The influence of approach and avoidance motor actions on food intake. *European Journal of Social Psychology*, *33*(3), 339–350. doi: 10.1002/ejsp.150

Folk, J. B., Disabato, D. J., Goodman, F. R., Carter, S. P., DiMauro, J. C., & Riskind, J. H. (2017). Wise additions bridge the gap between social psychology and clinical practice: Cognitive-behavioral therapy as an exemplar. *Journal of Psychotherapy Integration*, *27*(3), 407–423. doi: 10.1037/int0000038

Fredrickson, B. L., & Roberts, T. A. (1997). Objectification Theory: Toward Understanding Women's Lived Experiences and Mental Health Risks. *Psychology of Women Quarterly*, *21*(2), 173–206. doi: 10.1111/j.1471-6402.1997.tb00108.x

Garrison, K. E., Tang, D., & Schmeichel, B. J. (2016). Embodying Power: A Preregistered Replication and Extension of the Power Pose Effect. *Social Psychological and Personality Science*, *7*(7), 623–630. doi: 10.1177/1948550616652209

Glenberg, A. M. (2010). Embodiment as a unifying perspective for psychology. *European Journal of Social Psychology*, *39*(7), 1135–1141. doi: 10.1002/ejsp.670

Glenberg, A. M., Witt, J. K., & Metcalfe, J. (2013). From the Revolution to Embodiment: 25 Years of Cognitive Psychology. *Perspectives on Psychological Science*, *8*(5), 573–585. doi: 10.1177/1745691613498098

Goldinger, S. D., Papesh, M. H., Barnhart, A. S., Hansen, W. A., & Hout, M. C. (2016). The poverty of embodied cognition. *Psychonomic Bulletin and Review*, *23*(4), 959–978. doi: 10.3758/s13423-015-0860-1

Gronau, Q. F., Van Erp, S., Heck, D. W., Cesario, J., Jonas, K. J., & Wagenmakers, E.-J. (2017). A Bayesian model-averaged meta-analysis of the power pose effect with informed and default priors: the case of felt power. *Comprehensive Results in Social Psychology*, *2*(1), 123–138. doi: 10.1080/23743603.2017.1326760

Hauke, G., Lohr, C., & Pietrzak, T. (2017). Moving the mind: Embodied cognition in Cognitive Behavioural Therapy (CBT). *European Psychotherapy*, 154–178.

Havas, D. A., Glenberg, A. M., Gutowski, K. A., Lucarelli, M. J., & Davidson, R. J. (2010). Cosmetic use of botulinum toxin-a affects processing of emotional language. *Psychological Science*, *21*(7), 895–900. doi: 10.1177/0956797610374742

Hurley, S. (2001). Perception and Action: Alternative Views. *Cognition, 129*(1), 3–40. doi: 10.1111/1467-8349.00078

James, W. (1890). *Principles of psychology*. New York, NY: Holt, Rinehart & Winston.

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition and Emotion*, *23*(1), 4–41. doi: 10.1080/02699930802619031

Koole, S. L., & Rothermund, K. (2011). "I feel better but I don't know why": The psychology of implicit emotion regulation. *Cognition and Emotion*, *25*(3), 389–399. doi: 10.1080/02699931.2010.550505

Koole, S. L., & Veenstra, L. (2015). Does Emotion Regulation Occur Only Inside People's Heads? Toward a Situated Cognition Analysis of Emotion-Regulatory Dynamics. *Psychological Inquiry*, *26*(1), 61–68. doi: 10.1080/1047840X.2015.964657

Körner, A., Topolinski, S., & Strack, F. (2015). Routes to embodiment. *Frontiers in Psychology*, *6*(940), 1–10. doi: 10.3389/fpsyg.2015.00940

Kozak, M. N., Roberts, T. A., & Patterson, K. E. (2014). She stoops to conquer? How posture interacts with self-objectification and status to impact women's affect and performance. *Psychology of Women Quarterly*, *38*(3), 414–424. doi: 10.1177/0361684313517865

Laham, S. M., Kashima, Y., Dix, J., & Wheeler, M. (2015). A meta-analysis of the facilitation of arm flexion and extension movements as a function of stimulus valence. *Cognition and Emotion*, *29*(6), 1069–1090. doi: 10.1080/02699931.2014.968096

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago, IL: University of Chicago Press.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought.* New York: Basic Books.

Laird, J. D. (1974). Self-attribution of emotion: The effects of expressive behavior on the quality of emotional experience. *Journal of personality and social psychology*, *29*(4), 475. doi: 10.1037/h0036125

Laird, J. D., & Lacasse, K. (2014). Bodily influences on emotional feelings: Accumulating evidence and extensions of William James's theory of emotion. *Emotion Review*, *6*(1), 27–34. doi: 10.1177/1754073913494899

Lang, P. J. (1979). A Bio-Informational Theory of Emotional Imagery. *Psychophysiology*, *16*(6), 495-512. doi: 10.1111/j.1469-8986.1979.tb01511.x

Lindeman, L. M., & Abramson, L. Y. (2008). The Mental Simulation of Motor Incapacity in Depression. *Journal of Cognitive Psychotherapy*, *22*(3), 228–249. doi: 10.1891/0889-8391.22.3.228

Linehan, M. (1993). *Cognitive-behavioral treatment of borderline personality disorder*.

New York, NY: Guilford press.

Linehan, M. (2015). *DBT skills training manual.* New York, NY: Guilford Press.

Michalak, J., Burg, J., & Heidenreich, T. (2012). Don't Forget Your Body: Mindfulness, Embodiment, and the Treatment of Depression. *Mindfulness*, *3*(3), 190–199. doi: 10.1007/s12671-012-0107-4

Michalak, J., Mischnat, J., & Teismann, T. (2014). Sitting posture makes a difference-embodiment effects on depressive memory bias. *Clinical Psychology and Psychotherapy*, *21*(6), 519–524. doi: 10.1002/cpp.1890

Michalak, J., Rohde, K., & Troje, N. F. (2015). How we walk affects what we remember: Gait modifications through biofeedback change negative affective memory bias. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 121–125. doi: 10.1016/j.jbtep.2014.09.004

Michalak, J., Troje, N. F., Fischer, J., Vollmar, P., Heidenreich, T., & Schulte, D. (2009). Embodiment of sadness and depression-gait patterns associated with dysphoric mood. *Psychosomatic Medicine*, *71*(5), 580–587. doi: 10.1097/PSY.0b013e3181a2515c

Nair, S., Sagar, M., Sollers, J., Consedine, N., & Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology*, *34*(6), 632–641. doi: 10.1037/hea0000146

National Institute for Health and Care Excellence (NICE). (2009). Borderline personality disorder: recognition and management. NICE guidelines [CG78]. Retrieved from https://www.nice.org.uk/guidance/cg78

National Institute for Health and Care Excellence (NICE). (2009). Depression in adults: recognition and management. NICE guidelines [CG90]. Retrieved from https://www.nice.org.uk/guidance/cg90

Newel, A., & Simon, H. A. (1976). Computer Science as empirical Inquiry: Symbols and Search. *Communications of the ACM*, *19*(3), 113–126. doi: 10.1145/360018.360022

Niedenthal, P. M. (2007). Embodying emotion. *Science*, *316*(5827), 1002–1005. doi: 10.1126/science.1136930

Niedenthal, P. M., Barsalou, L. W., Ric, F., & Krauth-Gruber, S. (2005). Embodiment in the acquisition and use of emotion knowledge. In L.F. Barrett, P.M. Niedenthal, & P. Winkielman (Eds.), *Emotion and Consciousness* (pp. 21–50). New York, NY: Guilford.

Niedenthal, P. M., Winkielman, P., Mondillon, L., & Vermeulen, N. (2009). Embodiment of Emotion Concepts. *Journal of Personality and Social Psychology*, *96*(6), 1120–1136. doi: 10.1037/a0015574

Oosterwijk, S., Rotteveel, M., Fischer, A. H., & Hess, U. (2009). Embodied emotion concepts: How generating words about pride and disappointment influences

posture. *European Journal of Social Psychology, 39*(3), 457-466. doi: 10.1002/ejsp.584

Peper, E., & Lin, I. M. (2012). Increase or Decrease Depression: How Body Postures Influence Your Energy Level. *Biofeedback*, *40*(3), 125–130. doi: 10.5298/1081-5937-40.3.01

Price, T. F., Peterson, C. K., & Harmon-Jones, E. (2012). The emotive neuroscience of embodiment. *Motivation and Emotion*, *36*(1), 27–37. doi: 10.1007/s11031-011-9258-1

Rahona, J. J., Ruiz Fernández, S., Rolke, B., Vázquez, C., & Hervás, G. (2014). Overt head movements moderate the effect of depressive symptoms on mood regulation. *Cognition and Emotion*, *28*(7), 1328–1337. doi: 10.1080/02699931.2014.881323

Ranehill, E., Dreber, A., Johannesson, M., Leiberg, S., Sul, S., & Weber, R. A. (2015). Assessing the Robustness of Power Posing: No Effect on Hormones and Risk Tolerance in a Large Sample of Men and Women. *Psychological Science*, *26*(5), 653–656. doi: 10.1177/0956797614553946

Riskind, J. H. (1983). Nonverbal expressions and the accessibility of life experience memories: A congruence hypothesis. *Social Cognition, 2*(1), 62-86.https://doi.org/10.1521/soco.1983.2.1.62

Riskind, J. H., & Gotay, C. C. (1982). Physical Posture : Could It Have Regulatory pr Feedback Effects on Motivation and Emoton? *Motivation and Emotion*, *6*(3), 273–297.

Roberts, T. A., & Arefi-Afshar, Y. (2007). Not all who stand tall are proud: Gender differences in the proprioceptive effects of upright posture. *Cognition and Emotion*, *21*(4), 714–727. doi: 10.1080/02699930600826432

Segal, Z. V., Williams, J. M. G., Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: a new approach to preventing relapse*. New York, NY: Guilford Press.

Simmons, J. P., & Simonsohn, U. (2017). Power Posing: P-Curving the Evidence. *Psychological Science*, *28*(5), 687–693. doi: 10.1177/0956797616658563

Smith, E.R., & Semin, G.R. (2004). Socially situated cognition: Cognition in its social context.. *Advances in experimental social psychology, 36*, 53-117.

Strack, F., Martin, L. L., & Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: A nonobtrusive test of the facial feedback hypothesis. *Journal of Personality and Social Psychology*, *54*(5), 768–777. doi: 10.1037/0022-3514.54.5.768

Teasdale, J. D., Barnard, P. J. (1993). *Affect, cognition and change: Remodelling depressive thought*. Hove, East Sussex: Psychology Press.

Teasdale, J. D., Segal, Z., & Williams, J. M. G. (1995). How does cognitive therapy

prevent depressive relapse and why should attentional control (mindfulness) training help? *Behaviour Research and Therapy*, *33*(1), 25–39. doi: 10.1016/0005-7967(94)E0011-7

Tom, G., Pettersen, P., Lau, T., Burton, T., & Cook, J. (1991). The Role of Overt Head Movement in the Formation of Affect. *Basic and Applied Social Psychology*, *12*(3), 281–289. doi: 10.1207/s15324834basp1203_3

Tsai, H. Y., Peper, E., & Lin, I. M. (2016). EEG patterns under positive/negative body postures and emotion recall tasks. *NeuroRegulation*, *3*(1), 23–27. doi: 10.15540/nr.3.1.23

Veenstra, L., Schneider, I. K., & Koole, S. L. (2016). Embodied mood regulation: the impact of body posture on mood recovery, negative thoughts, and mood-congruent recall. *Cognition and Emotion*, *31*(7), 1361–1376. doi: 10.1080/02699931.2016.1225003

Wagenmakers, E. J., Beek, T., Dijkhoff, L., Gronau, Q. F., Acosta, A., Adams, R. B., … Zwaan, R. A. (2016). Registered Replication Report: Strack, Martin, & Stepper (1988). *Perspectives on Psychological Science*, *11*(6), 917–928. doi: 10.1177/1745691616674458

Walton, G. M. (2014). The New Science of Wise Psychological Interventions. *Current Directions in Psychological Science*, *23*(1), 73–82. doi: 10.1177/0963721413512856

Weisfeld, G. E., & Beresford, J. M. (1982). Erectness of posture as an indicator of dominance or success in humans. *Motivation and Emotion*, *6*(2), 113–131. doi: 10.1007/BF00992459

Wells, G. L., & Petty, R. E. (1980). The effects of over head movements on persuasion: Compatibility and incompatibility of responses. *Basic and Applied Social Psychology, 1*(3), 219-230. doi: 10.1207/s15324834basp0103_2

Wiers, R. W., Eberl, C., Rinck, M., Becker, E. S., & Lindenmeyer, J. (2011). Retraining automatic action tendencies changes alcoholic patients' approach bias for alcohol and improves treatment outcome. *Psychological Science*, *22*(4), 490–497. doi: 10.1177/0956797611400615

Wilkes, C., Kydd, R., Sagar, M., & Broadbent, E. (2017). Upright posture improves affect and fatigue in people with depressive symptoms. *Journal of Behavior Therapy and Experimental Psychiatry*, *54*, 143–149. doi: 10.1016/j.jbtep.2016.07.015

Wilson, A. D., & Golonka, S. (2013). Embodied Cognition is Not What you Think it is. *Frontiers in Psychology*, *4*(58), 1–13. doi: 10.3389/fpsyg.2013.00058

Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin and Review*, *9*(4), 625–636. doi: 10.3758/BF03196322

Wilson, V. E., & Peper, E. (2004). The effects of upright and slumped postures on the recall of positive and negative thoughts. *Applied Psychophysiology Biofeedback*,

29(3), 189–195. doi: 10.1023/B:APBI.0000039057.32963.34

Winkielman, P., Niedenthal, P., Wielgosz, J., Eelen, J., & Kavanagh, L.C. (2015). Embodiment of cognition and emotion. In M. Mikulincer, P.R. Shaver, E. Borgida, J.A. Bargh (Eds.), *APA handbooks in psychology. APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 151-175). Washington, DC, US: American Psychological Association.

Wollmer, M. A., De Boer, C., Kalak, N., Beck, J., Götz, T., Schmidt, T., … Kruger, T. H. C. (2012). Facing depression with botulinum toxin: A randomized controlled trial. *Journal of Psychiatric Research*, *46*(5), 574–581. doi: 10.1016/j.jpsychires.2012.01.027

Zhang, X., Yu, H. W., & Barrett, L. F. (2014). How does this make you feel? A comparison of four affect induction procedures. *Frontiers in Psychology*, *5*(689), 1–10. doi: 10.3389/fpsyg.2014.00689

CHAPTER 2. Study 1

How posture may help in giving a speech: The role of posture expansiveness on an exposure task

---

This chapter is currently under review as: Miragall, M., Cebolla, A., Etchemendy, E., Baños, R.M. How posture may help in giving a speech: The role of posture expansiveness on an exposure task.

Abstract

A growing body of evidence framed in embodied cognition and emotion theories has shown the positive effects of adopting expansive (vs. contractive) postures on emotional, cognitive, and behavioral processes. However, the study of the role of posture in social anxiety has been largely neglected. The main objective of the present study was to analyze the affective and cognitive effects of posture expansiveness in an impromptu speech in women with fear of public speaking. The sample was composed of 56 women (M = 21.13, SD = 1.78 years old) with moderate to high fear of public speaking. They were randomly assigned to the expansive (n = 27) or contractive (n = 29) posture condition, where body expansiveness and the position of the back were manipulated before and during delivery of an impromptu speech. Participants filled out self-reported measures related to affect, cognitions, and exposure-related negative emotions at baseline, as well as before and during the speech. A mixed ANCOVA showed that participants in the expansive (vs. contractive) condition had less negative cognitions before and during the speech. Moreover, a moderation analysis showed that participants in the expansive (vs. contractive) condition with higher fear of public speaking had lower scores on negative affect before giving the speech. However, a chi-square test indicated that most of the participants in both conditions considered that adopting the posture was an impediment to giving the speech. Future studies should include men and a clinical population in the sample and explore the advantages of maintaining the posture during exposure to anxiety-provoking stimuli. Several clinical implications related to exposure therapy for social anxiety are discussed.

Keywords: posture; expansiveness; embodied cognition; public speaking; social anxiety.

1. Introduction

Social anxiety disorder (SAD)[1] is characterized by a persistent, intense, and chronic fear or anxiety about one or more social situations in which the person is exposed to the possibility of being scrutinized by others. The most prevalent fear in individuals suffering from this disorder is speaking or performing in public (e.g., giving a speech) (Furmark, 2002; Ruscio et al., 2008). Several cognitive (e.g., intense fear of showing anxiety symptoms that will be negatively evaluated by others), affective (e.g., feelings of fear or anxiety), and behavioral symptoms (e.g., social situations are avoided or endured with intense fear or anxiety) shape this disorder (American Psychiatric Association, 2013). Epidemiological surveys carried out in the US and Europe have shown that SAD is one of the most common anxiety disorders. Around 2.8-13% of the population is affected by this disorder during their lifetime, and the rate is almost twice as high in women as in men (Bandelow & Michaelis, 2015).

Cognitive behavioral therapy (CBT) has been identified as the intervention of choice to treat SAD (Mayo-Wilson et al., 2014; Ponniah & Hollon, 2008). One of the core components of CBT is the exposure technique, which generally consists of constructing an individualized hierarchy of anxiety-provoking situations that the individuals have to face progressively. Moreover, the individuals should remain in the feared situation until the fear has decreased before moving on to the next feared situation, and they should be psychologically engaged (e.g., paying full attention) in order to

[1] *Abbreviations:* SAD = Social anxiety disorder; CBT = Cognitive behavioral therapy; PRCS = Personal Report of Confidence as a Speaker; SCS = Self-consciousness Scale; BFNE = Brief Fear of Negative Evaluation Scale; SAD = Social Avoidance and Distress Scale; PANAS = Positive and Negative Affect Scales; SSPS = Self-Statements during Public Speaking; NES = Negative Emotions' Scale; PPS = Perceived Performance Scale; IST = Impromptu Speech Task.

produce habituation and extinction of the fear (Heimberg, 2002). Both pure exposure and exposure combined with cognitive therapy have been shown to be effective in the treatment of SAD (Feske & Chambless, 1995; Mayo-Wilson et al., 2014). However, more research is needed to improve the management of SAD because not all patients respond to the therapy (Stein & Stein, 2008). One attempt to enhance the efficacy of the exposure technique for SAD involves the administration of D-cycloserine –a glutamatergic agent that enhances the extinction of conditioned fear in animal models– before the exposure sessions (Hofmann, Wu, & Boettcher, 2013).

An aspect that has been largely neglected in exposure therapy for SAD is the body posture individuals adopt. Nevertheless, posture seems to play an important role in this disorder. Weeks, Heimberg, and Heuer (2011) found that higher social anxiety levels in men were positively associated with a stooped and contractive posture in a semi-structured social situation involving social competition, and they proposed that the stooped or contractive posture is a behavioral marker of SAD.

Moreover, a growing body of evidence framed in embodied cognition and emotion theories (Barsalou, 2008; Niedenthal, 2007; Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015) has shown the positive effects of adopting expansive or upright (vs. contractive or stooped) postures on emotional, cognitive, behavioral, and physiological processes. Expansive or upright (vs. contractive or stooped) postures have been related to increased feelings of power and hormonal changes associated with greater dominance (testosterone) and less stress (cortisol) (Carney, Cuddy, & Yap, 2010), better overall performance during a stressful job interview due to improved nonverbal behavior (Cuddy, Wilmuth, Yap, & Carney, 2015), greater confidence in individuals' self-attributes (Briñol, Petty, & Wagner, 2009), as well as higher self-esteem, more arousal, more positive mood, less fear, more positive spoken emotion words and less negative spoken

emotion words, and more spoken words in general during a stressful speech task (Nair, Sagar, Sollers, Consedine, & Broadbent, 2015). Moreover, a recent Bayesian meta-analysis of preregistered studies showed the connection between expansive postures and increases in self-reported felt power (Gronau et al., 2017). Along the same lines, *p*-curve analyses, based on a systematic review of studies related to the expansiveness of the posture, revealed strong support for the postural effects on feelings of power, and even stronger on emotions, affect and self-evaluations (Cuddy, Schultz, & Fosse, 2018).

To the best of our knowledge, only one recent study has analyzed the efficacy of adopting "power" or expansive postures (vs. submissive/contractive postures vs. resting postures) as strategies to enhance exposure therapy in individuals diagnosed with SAD (Davis et al., 2017). In this randomized controlled trial, individuals with SAD participated in three sessions of exposure where the posture manipulation was carried out before the exposure for a short period of time. Changes in testosterone and cortisol were analyzed, as well as the ratings of fear –measured on a scale ranging from 0 to 100–. Although the exposure therapy resulted in decreased SAD symptom severity in all the conditions one week later, the hormonal levels of testosterone and cortisol, the ratings of fear during each exposure session, and the SAD symptoms were not significantly different across conditions. However, this study leaves some unanswered questions about the role of posture in exposure therapy in individuals with SAD, such as: how long the posture should be maintained (e.g., Does adopting an expansive posture during exposure to anxiety-provoking stimuli have positive effects on the exposure outcomes?); the type of exposure outcomes that are modified (e.g., Are other exposure outcomes –apart from the fear or hormonal changes– modified due to the adoption of an expansive posture?); or the effect the posture has before dealing with the exposure (e.g., Are there positive effects on

emotional and cognitive processes, such as less anticipatory negative emotions, before the stressful situation due to adopting an expansive posture?).

Hence, the general purpose of the present study is to explore the effect of an expansive (vs. contractive) posture before and during an anxiety-provoking situation on several outcomes in individuals with fear of public speaking. Although some studies have found no effects of expansive postures (e.g., Garrison, Tang, & Schemeichel, 2016; Ranehill et al., 2015; Simmons & Simonsohn, 2017) –not even in SAD (Davis et al., 2017)–, extensive empirical evidence points out that expansive postures have positive effects on affective and emotional processes (e.g., changing specific emotion states or self-evaluations) (e.g., Cuddy et al., 2018), including in stressful tasks (Cuddy et al., 2015; Nair et al., 2015). Moreover, in the present study, the expansiveness of the posture is manipulated during the stressful task (as well as before) in order to maintain its possible effects for a longer time. Additionally, the participant's back (upright vs. stooped) and body expansiveness are manipulated in order to strengthen their possible effects. Taken together, modifying the bodily states (that is, adopting an expansive or a contractive posture) would be expected to directly modify the individual's feelings or information processing (Körner, Topolinski, & Strack, 2015).

The specific objectives of this study are: (1) to examine the effects of an expansive (vs. contractive)[2] posture on affect, cognitions, and exposure-related negative emotions (anxiety, non-dominance, avoidance desire) before and during a speech in young adult women with fear of public speaking; (2) to analyze whether fear of public speaking is a moderator variable in the effect of posture on affect, cognitions, and exposure-related negative emotions, both before and during the speech; (3) to explore whether the posture

[2] Even though the procedure involves manipulating the participants' backs, the nomenclature "expansive-contractive" will be used to aid the reading.

is considered a facilitator, an impediment, or irrelevant to performing the speech; and (4) to examine the effect of the expansive (vs. contractive) posture on the rating of the anticipatory performance before the speech and the overall performance after the speech.

The first hypothesis is that participants in the expansive (vs. contractive) condition will experience more positive affect and cognitions, as well as less negative affect, negative cognitions, and exposure-related negative emotions, both before and during giving a speech. The second hypothesis is that fear of public speaking will moderate the effect of posture on affect, cognitions, and exposure-related emotions, before and during giving the speech. That is, participants with higher fear of public speaking will achieve even more negative scores on affect, cognitions, and exposure-related emotions when adopting a contractive posture compared to an expansive posture. This hypothesis is based on the Weeks et al. (2011) study, which found a positive association between social anxiety and a contractive posture. Along the same lines, the third hypothesis is that a higher percentage of participants in the expansive (vs. contractive) condition will consider the posture to be a facilitator of giving the speech because the expansive posture may facilitate social skills (e.g., an open posture or looking at the audience) that are appropriate when speaking in public. Finally, the fourth hypothesis is that participants in the expansive (vs. contractive) posture will score higher on their anticipatory performance before the speech and the overall performance after the speech.

2. Method

2.1. Participants

The sample size was determined using *G*Power 3* (Faul, Erdfelder, Lang, & Buchner, 2007), and a total of 31 participants per group were estimated to be needed in the sample in order to detect a medium effect size (Cohen's d = 0.60) on the primary

outcomes, taking into account the effect size found in other studies on feelings of power (e.g., Carney et al., 2010; Cuddy et al., 2015), an alpha error of .05, and a statistical power of .80. Four more participants were randomized to preserve the statistical power in case of exclusions. The eligibility criteria for the present study included being a woman aged 18 or older, and scoring ≥ 105[3] on the Personal Report of Confidence as a Speaker (PRCS, Bados, 1986; Paul, 1966). The exclusion criterion was currently receiving psychological treatment.

The sample was recruited in Psychology classrooms at the University of Valencia, where researchers invited the students to participate in a study related to anxiety, without specifying the purpose of the experiment. We also placed advertisements on several bulletin boards at the University of Valencia. After participants indicated that they would like to participate, they filled out the screening questionnaires, and only participants who met the inclusion criteria were invited by phone to participate, without specifying the purpose of the experiment.

The screening questionnaires were completed by 294 students, but only 127 met the criteria to participate. However, 33 of them did not response to the call, 19 declined to participate in the experiment for different reasons (e.g., incompatibility of schedule, they were not interested in the end), and 9 did not come to the laboratory appointment.

A total of 66 women with moderate or high fear of public speaking participated in the experiment. However, 10 participants were excluded because 5 did not finish the experimental task and 5 did not maintain the posture during the task[4]. Thus, the total sample was composed of 56 women between 18 and 25 years old (M = 21.13, SD = 1.78).

[3] This cut-off is the central value of the PRCS, equivalent to a moderate fear in public speaking.

[4] Two independent evaluators assessed the body posture of each participant on a 4-point scale (4 = all the time, 3 = most of the time; 2 = sometimes; 1 = seldom), and if both evaluators agreed on

All the participants signed informed consent documents before filling out the screening questionnaire and starting the experiment, in accordance with the Declaration of Helsinki. The Ethics Committee at the University of Valencia approved the study.

2.2. Measures

2.2.1. Fear of public speaking: Personal Report of Confidence as Speaker

(PRCS, Bados, 1986; Paul, 1966). It is a 30-item self-report questionnaire that assesses behavioral and affective responses to public-speaking situations (e.g., *"I am not afraid of being in front of the public"*). Items are rated on a 6-point Likert scale (1 = completely agree; 6 = completely disagree), and they refer to public speaking in general (instead of the last speech). The total score ranges from 30 (no fear of public speaking) to 180 (highest level of fear). Méndez, Inglés, and Hidalgo (1999) validated the Spanish psychometric properties of Bados' version in a sample of adolescents, and the questionnaire showed high internal consistency (α = .91). Gallego, Botella, Quero, García-Palacios, and Baños (2007) also found adequate internal consistency in a clinical sample (α = .89). Cronbach's alpha for this sample was α = .80.

2.2.2. Self-consciousness and social anxiety: Self-consciousness Scale

(SCS; Scheier & Carver, 1985). It is a 22-item self-report questionnaire with three subscales that measure: (a) public self-consciousness (general awareness of the self as a social object that influences others, e.g., *"I care a lot about how I present myself to others"*) (9 items;

---

the non-maintenance of the posture "most of the time" ($\geq$ 3), the participant was excluded from the analyses (e.g., "most of the time" arms were touching the upper body, participants were not taking up a lot of space, or they were stooped in the "expansive" condition).

sub-scores between 0 and 27); (b) private self-consciousness (the tendency to attend to one's inner thoughts and feelings, e.g., *"I think about myself a lot"*) (7 items; sub-scores between 0 and 21); (c) Social anxiety (discomfort felt in the presence of others, e.g., *"It is easy for me to talk to strangers"*). The statements are rated on a 4-point scale (0 = not like me at all; 3 = a lot like me) (6 items; sub-scores between 0 and 18). Cronbach's alphas for the Scheier and Carver (1985) validation ranged from .75 to .84. The Spanish version (Baños, Belloch, & Perpiñá, 1990) of the questionnaire showed adequate internal consistency for all the subscales (α ranging from .75 to .81). Cronbach's alphas for the three subscales ranged from .76 to .80 for this sample.

2.2.3. Cognitive component of social anxiety: Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983). It is a self-report that measures the anxiety associated with being negatively evaluated by others. It consists of 12 items describing fearful or worrying cognitions (e.g., *"I rarely worry about what kind of impression I am making on someone"*), and participants have to indicate how characteristic each statement is of them on a 5-point Likert scale (1 = Not at all; 5 = Extremely). The total score ranges from 12 to 60. Higher scores indicate a greater tendency to get nervous in situations where one may be evaluated by others. Cronbach's alphas were adequate for the Leary (1983) validation and the Spanish version (Gallego, Botella, Quero, Baños, & García-Palacios, 2007) (α = .90 in both cases). Cronbach's alpha for this sample was α = .92.

2.2.4. Emotional and Behavioral component of social phobia: Social Avoidance and Distress Scale (SAD; Watson & Friend, 1969). It is a 28-item self-report questionnaire that measures distress in social situations (e.g., *"I am usually nervous with people unless I know them well"*), as well as avoidance and the desire to avoid these situations (e.g., *"I try to avoid situations that force me to be very sociable"*). Each

statement should be rated as true or false, and the total score ranges from 0 to 28. Internal consistency was adequate in the original validation (α = .94). In the Spanish version by Bobes et al. (1999), the internal consistency was also adequate (α = .84). Cronbach's alpha for this sample was α = .91.

2.2.5. Affect: Positive and Negative Affect Scales (PANAS; Watson, Clark, & Tellegen, 1988). It is a self-report questionnaire that consists of two 10-item mood scales: positive and negative affect. Participants are asked to rate the extent to which they have experienced each particular emotion within a specified time period, using a 5-point scale (1 = very slightly or not at all; 5 = very much). In this study, the time period specified was "at the moment". The total score for each subscale ranges from 5 to 50. For the Spanish version by Sandín et al. (1999), Cronbach's alphas for the positive and negative affect scales were adequate (between α = .87 and α = .91). Cronbach's alphas for the positive and negative affect scales were also adequate across administrations for this sample (Cronbach's alphas for positive and negative scales, respectively: baseline: α = .85 and α = .89; before the speech α = .85 and α = .89; during the speech: α = .88 and α = .83).

2.2.6. Cognitions: Self-Statements during Public Speaking (SSPS; Hofmann & DiBartolo, 2000; Rivero, García-López & Hofmann, 2010). It is a 10-item self-report questionnaire that measures negative and positive self-statements associated with a public speech. It consists of two 5-item subscales: the positive (e.g., *"What do I have to lose, it's worth a try"*) and negative self-statement (e.g., *"I am a loser"*) subscales. Each self-statement has to be rated on a 5-point scale (0 = strongly disagree; 5 = strongly agree). The original validation (Hofmann & DiBartolo, 2000) showed adequate internal consistency in a non-clinical sample, with Cronbach's alphas ranging from α = .75 to α =

.84 for the positive self-statements, and from α = .83 to α = .86 for the negative self-statements. The results of the Spanish validation by Rivero, Garcia-Lopez, and Hofmann (2010) in a sample of adolescents showed that this questionnaire had adequate internal consistency (positive self-statements α = .69; negative self-statements α = .86). Cronbach's alphas for the positive and negative self-statement scales were also adequate across administrations for this sample (Cronbach's alphas for positive and negative scales, respectively: baseline: α = .73 and α = .79; before the speech α = .72 and α = .84; during the speech: α = .83 and α = .84)

2.2.7. Exposure-related negative emotions: Negative Emotions' Scale (NES). A scale was constructed to assess emotions that may arise during exposure therapy for SAD: anxiety, non-dominance/control of the situation, and desire to avoid the situation. Each emotion is rated on a scale ranging from 1 (nothing) to 7 (completely). Because the inter-item correlations between the emotions were adequate (r > .20; Piedmont, 2014), a composite score was calculated to reduce the probability of type I error. The total score ranges from 3 to 21. The internal consistency was adequate across the administrations (Cronbach's alphas for baseline α = .69, before the speech α = .74, and during the speech: α = .74).

2.2.8. Perceived Performance: Perceived Performance Scale (PPS). Two PPS were constructed by the authors to assess the anticipatory performance before the speech (*"In general, how good do you think your performance will be during the speech?"*) and overall performance during the speech (*"In general, how good do you think your performance was during the speech?"*). Both scales ranged from 1 to 7 (1 = not valid; 2 = poor; 3 = very poor; 4 = not very good; 5 = good; 6 = very good; 7 = excellent).

2.3. The Impromptu Speech Task

The main task participants had to complete in the study was a variation on the Impromptu Speech Task (IST) (Beidel, Turner, Jacob, & Cooley, 1989), which is a reliable procedure for determining the physiological, cognitive, and behavioral symptoms of social phobia. The task consisted of giving an impromptu speech lasting at least 3 minutes to a small audience. For the IST, participants had to randomly choose 5 out of 20 general opinion topics provided by the researcher (e.g., "Internet", "movies at home or at the cinema", "politicians", "contamination problems", "pets", "celebrities", "TV advertisements", "new technologies", "copyright piracy", "soccer", "cosmetic surgery", "American or Spanish movies", "choosing a career by vocation or professional opportunities", "Spanish cinema", "TV programs", "Spanish monarchy", "gossip magazines", "vacations", "language learning", "slaves to fashion or not".), and they could use up to 3 of these 5 topics. Once participants had chosen the topics, they had 3 minutes to prepare their speeches. The audience was composed of three members of the research staff (one of them was the same researcher who was present during the experiment), and they were instructed to remain neutral throughout the IST, without showing any positive (e.g., smiling, nodding in agreement) or negative gestures (e.g., disagreeing, shaking their heads, yawning, sighs of disinterest). If participants stopped the IST before the 3 minutes, the experimenter encouraged them to continue with the speech. Participants were told that their speech would be videotaped, and its quality would be evaluated by two members of the research staff and the members of the audience.

2.4. Procedure

Participants were told that the study was related to anxiety and the effects of performing a task on physiological stress reactions. Then, they filled out the PANAS, the

SSPS, and the NES questionnaires to obtain the baseline measures. To support the cover story, the procedure used by Michalak, Mischnat, and Teismann (2014) was followed, and participants were asked to collect (false) saliva samples from their mouths to measure the levels of cortisol at the beginning and end of the experiment (these samples were not analyzed).

Participants were randomly assigned to the expansive or contractive posture condition using the Random Allocation Software 2.0 package (Saghaei, 2004). The body posture of participants was manipulated, and they were asked to remain in the expansive or contractive body posture for 2 minutes. To manipulate the participants' posture, we followed an adaptation of the procedure by Carney et al. (2010), manipulating the expansiveness of the body (taking up more physical space or less, and keeping arms and legs open or closed). Moreover, we also manipulated the participants' back, following Michalak et al. (2014), encouraging participants in the expansive and contractive posture to adopt an upright or a stooped posture, respectively. The experimenter gave the instructions verbally, modelled the body posture, and showed a photo of the body posture to the participants (see Figures 1 and 2). To adopt the expansive body posture, participants had to adopt an upright, open, and expansive body posture. To achieve this, participants had to sit back in a chair in an upright body position, and their arms had to remain open, without touching the upper body, taking up a lot of space. To facilitate the maintenance of the body posture, the participants' hands and feet had to rest on two marks placed on the table and on the floor, and they had to elevate their chins by looking at a fixation point placed on the wall in front of them. By contrast, to adopt the contractive body posture, participants had to adopt a stooped, closed, and contractive body posture, taking up little space. To achieve this body posture, participants had to interlace their fingers under the table to keep their arms touching their upper bodies. Their feet had to rest together on a

mark placed on the floor, and they had to let their head, neck, and shoulders fall forward. In both conditions, we told them that if they felt any pain or tension, they could move slightly and then return to the requested posture. Once the body posture had been manipulated, the experimenter stayed in the same room (but out of sight of the participant) to make sure that participants were adopting the required posture.

After 2 minutes, participants were asked to remain in the same body posture until the end of the experiment, and they were told that they had to give a speech to an audience. The IST (Beidel et al., 1989) was explained to the participants, and they filled out the PPS, the PANAS, the SSPS, and the NES questionnaires before choosing the topics of the speech. Then, participants had 3 minutes to prepare their speeches, and they gave the 3-minute speech in front of an audience, maintaining the requested body posture. If participants changed their posture, the researcher showed them a sign reminding them to adopt the body posture. The participants were videotaped in order to analyze whether they had maintained the body posture throughout the speech.

After the IST, they filled out the PPS, the PANAS, the SSPS, and the NES questionnaires, thinking about the feelings and thoughts they had experienced during the speech. Then, another (false) saliva sample was collected to support the cover story, and participants rated their level of "physical comfort" on a 7-point scale (1 = nothing at all; 7 = completely). Moreover, participants answered whether they thought the adopted posture facilitated, impeded, or was irrelevant to making the speech in public. The experiment lasted 30 minutes, and participants remained in the requested body posture for about 15 minutes (2' while adopting the posture before the IST, 3' while filling out the questionnaires before the IST, 3' while preparing the IST, 3' while doing the IST, 3' while filling out the questionnaires after the IST). At the end of the experiment, participants were asked their opinion of the study goal to make sure they had not

discovered the true aim of the experiment. Then they received a monetary compensation of €5 for their participation.

Figure 1. Expansive posture adopted during the experiment

Figure 2. Contractive posture adopted during the experiment

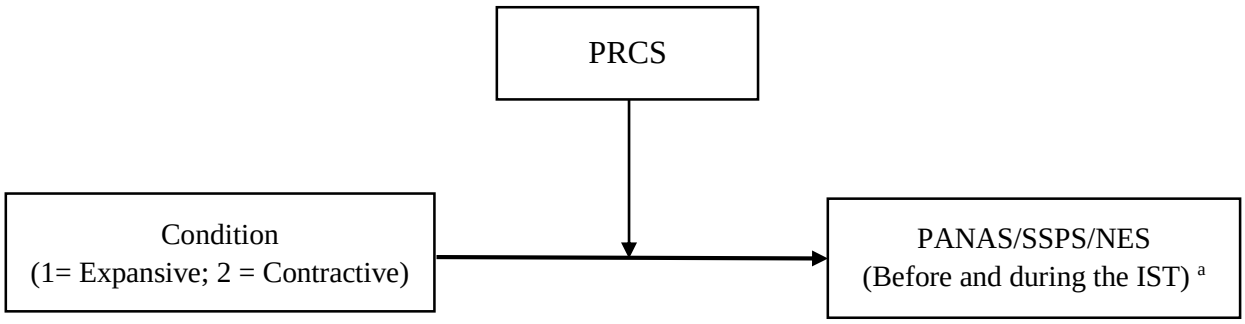
2.5. Data Analyses

Statistical analyses were performed using the SPSS v.24 software. First, the percentages of missing values from the PANAS and SCS were explored, with random missing value percentages ranging from 0 to 2% per item. Items' missing values were imputed using the Expectation-Maximization method. Second, descriptive statistics were calculated, and seven independent-samples t-tests were performed to verify that there were no significant differences in age, PRCS, SCS, BFNE, and SAD at baseline across conditions. Third, an independent-samples t-test was carried out to verify that there were no significant differences in physical comfort while adopting the posture.

Fourth, the effects of the posture on the primary outcomes (affect, cognitions, and exposure-related negative emotions) were analyzed using eight 2x2 mixed ANCOVAs with the condition (expansive and contractive) as between-subjects factor, time (before and during the IST) as within-subjects factor, and baseline scores as covariates. We explored: (1) the main effect of time, to analyze whether there were differences, on average, before and during the IST across the conditions; (2) the interaction effect between condition and time, in order to analyze whether there were differences before and during the IST depending on the condition; and (3) the main effect of condition, to find out whether there were constant differences between conditions in terms of higher or lower scores on the investigated variables at both points in time, on average. When the effects were significant, pairwise comparisons with Bonferroni corrections were performed.

Fifth, ten moderation analyses were carried out in order to test whether the fear of public speaking (PRCS) was a moderator of the effect of posture on affect (PANAS), cognitions (SSPS), and exposure-related negative emotions (NES). They were performed using the procedure described by Hayes (2013) from the PROCESS macro (version 2.16), choosing model 1. Baseline scores were entered as covariates of the dependent variable of each moderation model (see Figure 3). The expansive condition was coded as "1", and the contractive condition was coded as "2". All regression coefficients were reported in unstandardized form as b-values. Tests of significance ($p < .05$) or a confidence interval (not including zero) in the "condition x PRCS" interaction indicated whether the PRCS moderated the effect of condition on affect/cognitions/exposure-related negative emotions before and/or during the IST. We examined the conditional effect of condition on the dependent variable at medium (the mean), low (-1 SD), and high (+1 SD) levels of PRCS, using the pick-a-point approach (or analysis of simple slopes).

Figure 3. Graphic representation of the moderation analyses



Note. PRCS = Personal Report of Confidence as Speaker; PANAS = Positive and Negative Affect Scales; SSPS = Self-Statements during Public Speaking; NES = Negative Emotions' Scale. Baseline scores are entered as covariates of the dependent variable.

[a] The specific dependent variables in the 10 moderation analyses are: positive PANAS before and during the IST, negative PANAS before and during the IST, positive SSPS before and during the IST, negative SSPS before and during the IST, and ES before and during the IST.

Sixth, to analyze the differences in the percentages of participants who considered the posture to be a "facilitator", "impediment" or "irrelevant" in performing the IST in each condition, a chi-square test was performed using Monte Carlo with 10.000 samples and a 99% confidence level. When the absolute value of the Adjusted Standardized Residual was greater than 1.96, the relationship between the different categories was considered significant, and the sign indicated the type of relationship between the categories.

Finally, two independent-samples t-tests were performed to analyze the effect of the adopted posture on rating their own performance before and after the IST.

3. Results

3.1. Differences in age and social anxiety-related symptoms

Descriptive statistics for age and social anxiety-related symptoms for each condition are shown in Table 1. There were no significant differences between conditions for age, $t(54) = 1.62$, $p = .111$, $d = 0.43$; PRCS, $t(54) = 0.49$, $p = .623$, $d = 0.13$; BFNE, $t(50) = 0.66$, $p = .511$, $d = 0.18$; SAD, $t(49) = 1.27$, $p = .210$, $d = 0.36$; Public self-consciousness SCS, $t(49) = 0.14$, $p = .887$, $d = 0.04$; Private self-consciousness SCS, $t(49) = 0.17$, $p = .864$, $d = 0.05$; or Social Anxiety SCS, $t(49) = 1.61$, $p = .114$, $d = 0.45$.

Table 1. Descriptive statistics for age and social anxiety-related symptoms.

	Expansive condition (n = 27) *M (SD)*	**Contractive condition** (n = 29) *M (SD)*
Age (years)	21.52 (1.83)	20.76 (1.68)
PRCS	123.96 (14.49)	125.83 (13.76)
BFNE [a]	34.42 (7.77)	35.93 (8.55)
SAD	10.50 (7.52)	12.96 (6.32)
Public self-consciousness (SCS)	16.79 (2.86)	16.93 (3.71)
Private self-consciousness (SCS)	19.08 (4.50)	19.30 (4.36)
Social Anxiety (SCS)	11.88 (4.01)	13.48 (3.12)

Note. PRCS = Personal Report of Confidence as Speaker; SCS = Self-consciousness Scale; BFNE = Brief Fear of Negative Evaluation Scale; SAD = Social Avoidance and Distress Scale.

[a] Due to missing values, BFNE, SAD and SCS scores are calculated with $n = 24$ in the expansive condition, and $n = 27$ in the contractive condition.

3.2. Differences in physical comfort

Physical comfort while adopting the posture in the expansive condition (M = 3.78; SD = 1.48) was not significantly different from physical comfort in the contractive condition (M = 3.34; SD = 1.49), $t(54) = 1.09$, $p = .281$, $d = 0.29$.

3.3. Effect of posture on affect (PANAS), cognitions (SSPS), and exposure-related negative emotions (NES)

Descriptive statistics and repeated-measures ANCOVA results for PANAS and SSPS are displayed in Table 2 and Figure 4, and results for exposure-related negative emotions (NES) are displayed in Table 3 and Figure 5. Regarding the results for affect, there was a main effect of time on negative PANAS, indicating that, on average, across both conditions, there was more negative affect during the IST than before the IST. However, the main effect of time on positive PANAS, the interaction effects or the main effects of condition on positive and negative PANAS were not significant.

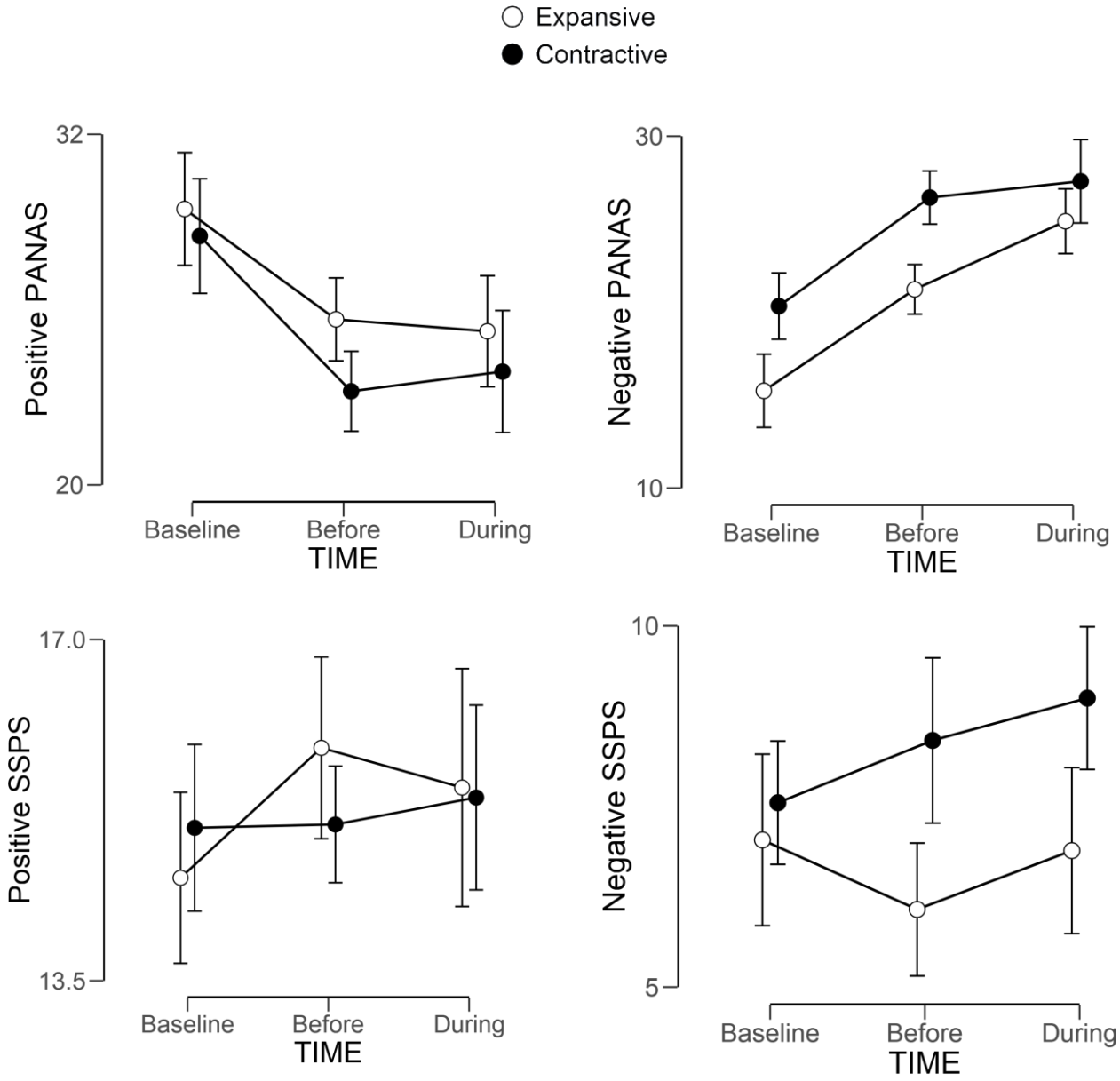
For cognitions, there was a main effect of condition on the negative SSPS, showing that participants in the expansive condition had less negative cognitions than participants in the contractive condition at both moments in time (before and during the speech), on average. However, the main effect of condition on positive SSPS, the interaction effects or the main effects of time on positive and negative SSPS were not significant.

Table 2. Descriptive statistics and repeated-measures ANCOVAs results for PANAS and SSPS.

	Expansive condition (n = 27)			**Contractive condition** (n = 29)			**ANCOVAs**[a]
	Baseline	*Before the IST*	*During the IST*	*Baseline*	*Before the IST*	*During the IST*	
PANAS							
Positive	29.44 (6.35)	25.67 (6.21)	25.26 (7.13)	28.52 (5.64)	23.21 (4.12)	23.88 (7.03)	*Main effect of time:* $F(1,53) = 0.27$, $p = .603$, $\eta^2_p = .01$ *Condition X Time effect:* $F(1,53) = 0.39$, $p = .533$, $\eta^2_p = .01$ *Main effect of condition:* $F(1,53) = 1.36$, $p = .248$, $\eta^2_p = .03$
Negative	15.53 (4.83)	21.30 (4.69)	25.17 (6.07)	20.34 (7.08)	26.52 (7.36)	27.44 (7.03)	*Main effect of time:* $F(1,53) = 12.32$, $p < .001$, $\eta^2_p = .19$ *Condition X Time effect:* $F(1,53) = 0.42$, $p = .522$, $\eta^2_p = .01$ *Main effect of condition:* $F(1,53) = 1.71$, $p = .196$, $\eta^2_p = .03$
SSPS							
Positive	14.56 (4.87)	15.89 (4.63)	15.48 (5.87)	15.07 (4.35)	15.10 (4.55)	15.38 (5.03)	*Main effect of time:* $F(1,53) = 0.06$, $p = .802$, $\eta^2_p = .00$ *Condition X Time effect:* $F(1,53) = 0.50$, $p = .483$, $\eta^2_p = .01$ *Main effect of condition:* $F(1,53) = 1.51$, $p = .224$, $\eta^2_p = .03$
Negative	7.04 (5.13)	6.07 (5.05)	6.89 (6.22)	7.55 (4.70)	8.41 (5.12)	9.00 (5.35)	*Main effect of time:* $F(1,53) = 0.15$, $p = .705$, $\eta^2_p = .00$ *Condition X Time effect:* $F(1,53) = 0.09$, $p = .771$, $\eta^2_p = .00$ *Main effect of condition:* $F(1,53) = 4.61$, $p = .036$, $\eta^2_p = .08$

Note. PANAS = Positive and Negative Affect Scales; SSPS = Self-Statements during Public Speaking; IST = Impromptu Speech Task. All values represent the means and standard deviations in parentheses. [a] All ANCOVAs are adjusted for baseline scores.

Figure 4. PANAS and SSPS scores in each condition and time.



Note. Error bars represent the 95% confidence interval of the mean.

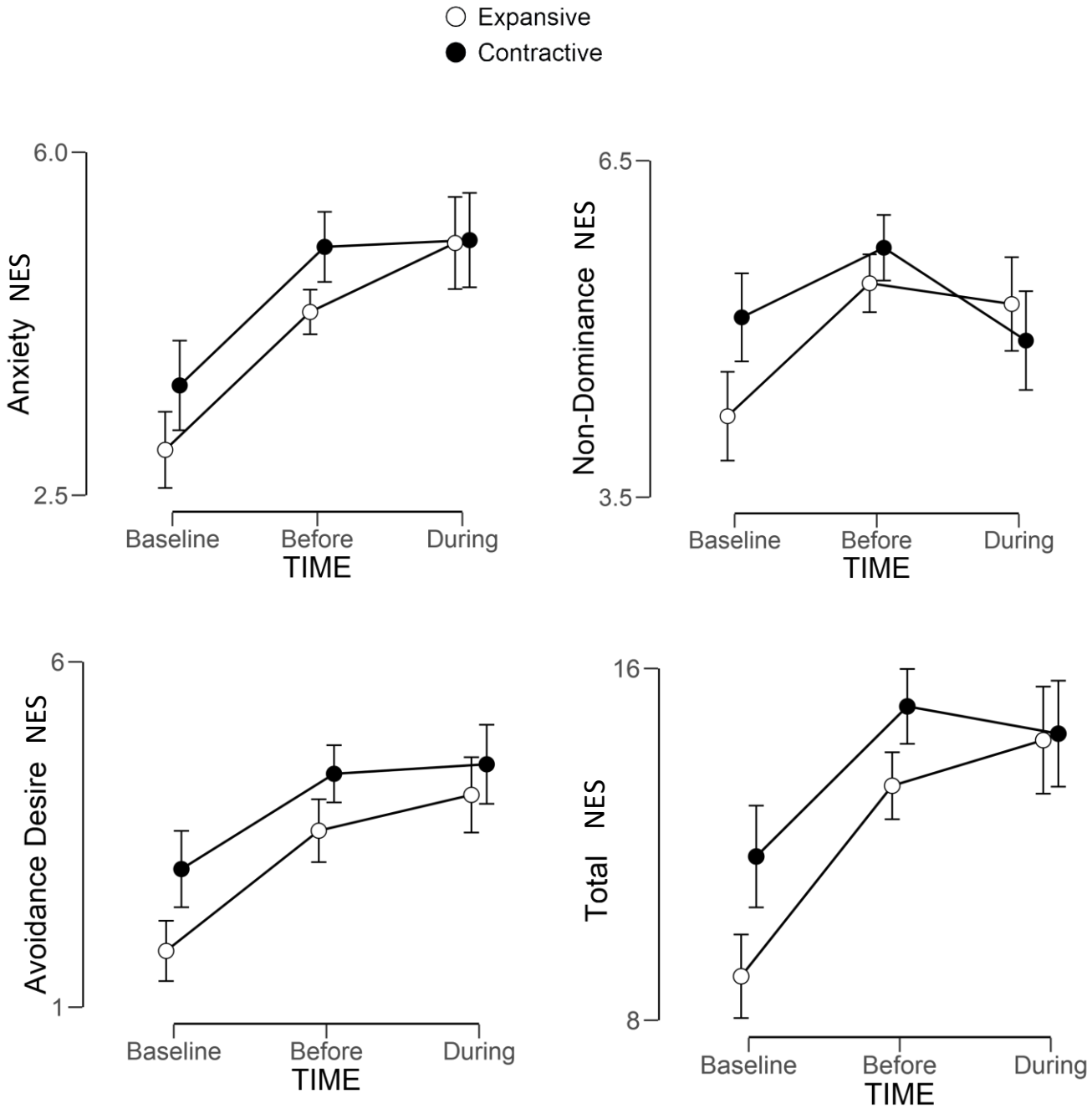
Regarding exposure-related negative emotions, there were main effects of time on anxiety and the total composite index of negative emotions (composed of anxiety, non-dominance, and avoidance desire), indicating that, on average, across both conditions, there were more exposure-related negative emotions during the IST than before the IST. The rest of the main effects of time, the main effects of condition, and the interaction effects were not significant.

Table 3. Descriptive statistics and repeated-measures ANCOVA results for exposure-related negative emotions (NES).

	Expansive condition (*n* = 27)			**Contractive condition** (*n* = 29)			**ANCOVAs**[a]
	Baseline	*Before the IST*	*During the IST*	*Baseline*	*Before the IST*	*During the IST*	
NES							
Total	9.00 (2.25)	13.33 (2.92)	14.37 (3.76)	11.72 (2.96)	15.14 (3.10)	14.52 (3.86)	*Main effect of time:* $F(1,53) = 4.39$, $p = .041$, $\eta^2_p = .08$ *Condition X Time effect:* $F(1,53) = 0.32$, $p = .572$, $\eta^2_p = .01$ *Main effect of condition:* $F(1,53) = 0.05$, $p = .819$, $\eta^2_p = .00$
Anxiety	2.96 (1.09)	4.37 (0.97)	5.07 (1.39)	3.62 (1.15)	5.03 (1.05)	5.10 (1.32)	*Main effect of time:* $F(1,53) = 8.44$, $p = .005$, $\eta^2_p = .14$ *Condition X Time effect:* $F(1,53) = 0.98$, $p = .327$, $\eta^2_p = .02$ *Main effect of condition:* $F(1,53) = 0.92$, $p = .343$, $\eta^2_p = .02$
Non-Dominance	4.22 (1.05)	5.41 (1.01)	5.22 (1.31)	5.10 (1.15)	5.72 (1.10)	4.90 (1.26)	*Main effect of time:* $F(1,53) = 2.92$, $p = .094$, $\eta^2_p = .05$ *Condition X Time effect:* $F(1,53) = 0.79$, $p = .379$, $\eta^2_p = .02$ *Main effect of condition:* $F(1,53) = 0.73$, $p = .395$, $\eta^2_p = .01$
Avoidance desire	1.82 (0.96)	3.56 (1.53)	4.07 (1.88)	3.00 (1.56)	4.38 (1.68)	4.52 (2.01)	*Main effect of time:* $F(1,53) = 1.57$, $p = .216$, $\eta^2_p = .03$ *Condition X Time effect:* $F(1,53) = 0.17$, $p = .685$, $\eta^2_p = .00$ *Main effect of condition:* $F(1,53) = 0.05$, $p = .816$, $\eta^2_p = .00$

Note. NES = Negative Emotions' Scale; IST = Impromptu Speech Task. All values represent the means and standard deviations in parentheses. [a] All ANCOVAs are adjusted for baseline scores.

Figure 5. Exposure-related NES scores in each condition and time.



Note. NES = Negative Emotions' Scale.

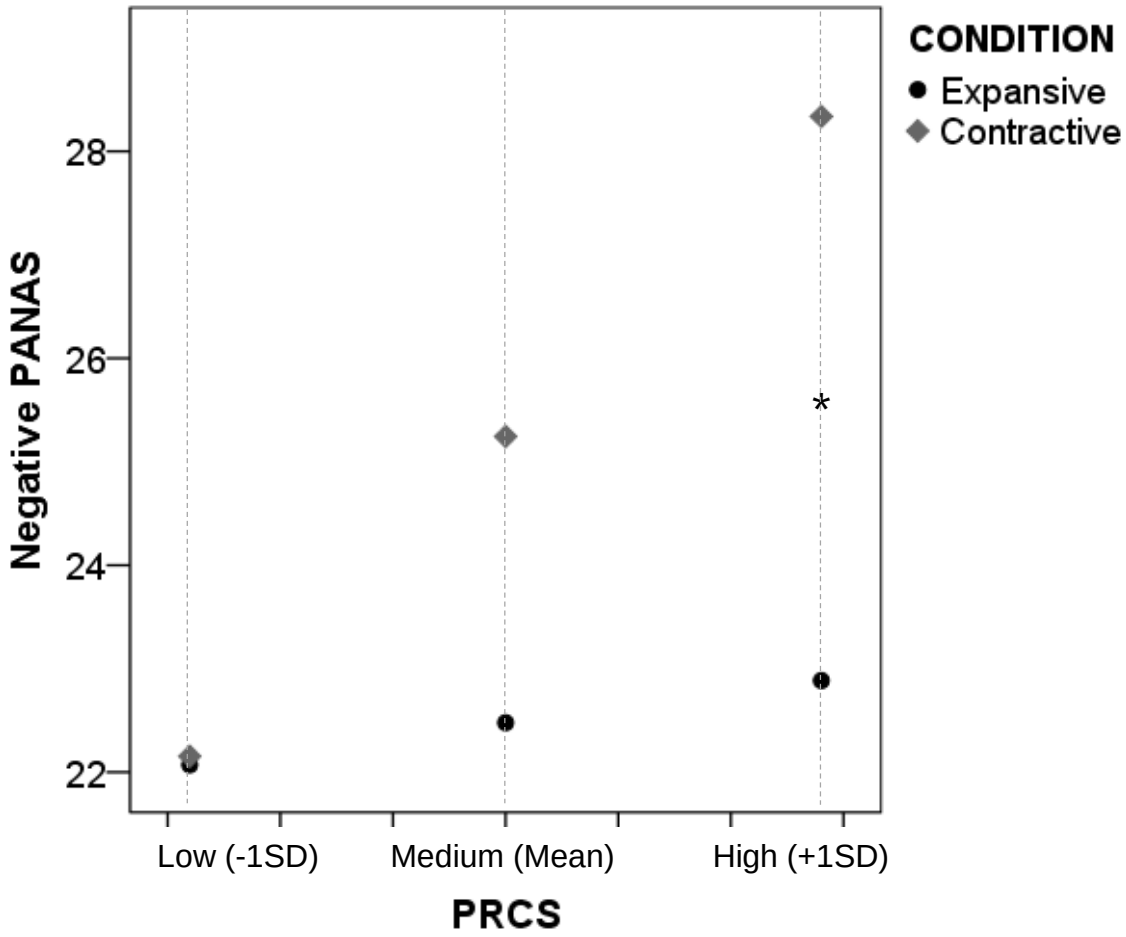
Error bars represent the 95% confidence interval of the mean.

3.4. The fear of public speaking (PRCS) as a moderator of the effect of posture on affect (PANAS), cognitions (SSPS), and exposure-related negative emotions (NES).

Moderation analyses showed that the level of fear of public speaking (PRCS) only moderated the effect of condition on the negative PANAS before the IST, but this moderation effect was not found for the other variables: the negative PANAS during the IST, $F(1,51) = 0.67$, $p = .416$; positive PANAS before the IST, $F(1,51) = 1.30$, $p = .260$; positive PANAS during the IST, $F(1,51) = 0.38$, $p = .540$; negative SSPS before the IST, $F(1,51) = 0.45$, $p = .507$; negative SSPS during the IST, $F(1,51) = 3.40$, $p = .071$; positive SSPS before the IST, $F(1,51) = 0.26$, $p = .615$; positive SSPS during the IST, $F(1,51) = 0.00$, $p = .999$; NES before the IST, $F(1,51) = 3.95$, $p = .052$; NES during the IST, $F(1,51) = 0.76$, $p = .387$.

Regarding the negative PANAS before the IST, the overall model explained 51.62% of the variance, $F(4,51) = 18.20$, $p < .001$. The interaction between condition and PRCS did not include the zero value in the confidence interval, $F(1,51) = 4.04$, $p = .050$, 95% CI [0.001, 0.383], indicating that the PRCS was a moderator of the effect of condition on the negative PANAS before the IST, accounting for 3.88% of the variance. Analyses of simple slopes showed that there was a significant positive relationship between condition and the negative PANAS before the IST when the PRCS was “high”, $b = 5.45$, 95% CI [0.498, 10.407], $t = 2.21$, $p = .032$. Participants in the expansive (vs. contractive) condition with higher PRCS achieved lower scores on negative affect before the IST (see Figure 6).

Figure 6. Simple slopes graph of the regression of condition on the negative PANAS before the IST at three levels of the PRCS (low, medium, high).

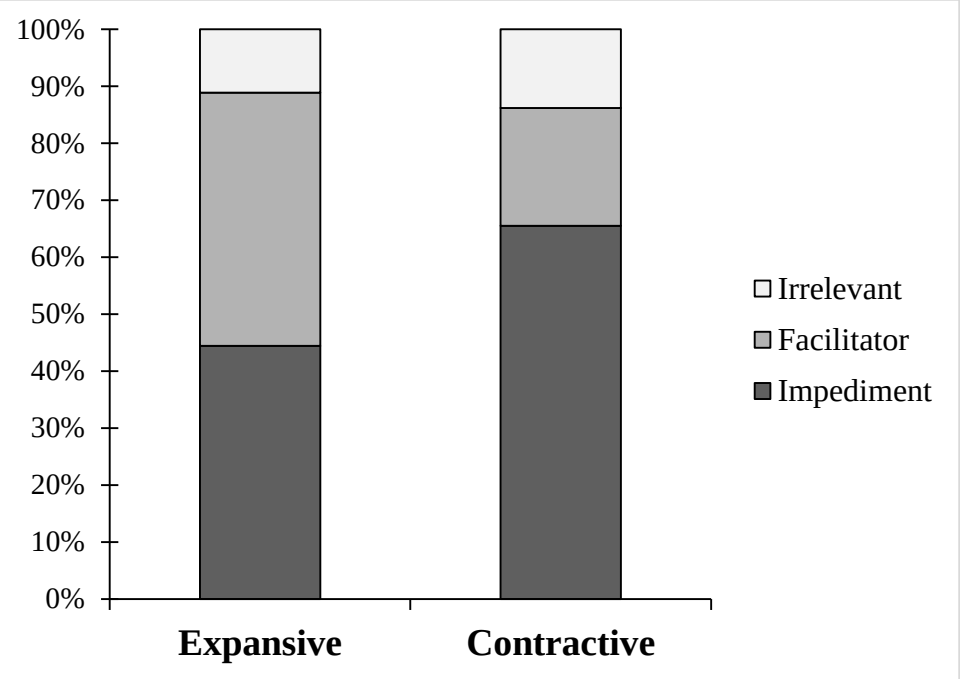


Note. PANAS = Positive and Negative Affect Scales; PRCS = Personal Report of Confidence as Speaker; IST = Impromptu Speech Task. "Low", "medium" and "high" levels of the moderators represent the mean and ± 1 standard deviation (SD) (PRCS: 124.93 ± 14.02). Significant p-values (* $p < .05$) represent the level of the moderator at which the conditional effect of condition on negative PANAS before the IST is significant.

3.5. Posture as “facilitator”, “impediment”, or “irrelevant” in performing the IST

Results showed that there were no significant differences in considering the posture to be a “facilitator”, “impediment”, or “irrelevant” in performing the IST, $\chi^2(2, N = 56) = 3.66$, $p = .190$, Cramer’s V = .256. Thus, 44.4% of the participants in the expansive condition and 65.5% of the participants in the contractive condition found the posture to be an “impediment” in performing the IST (Adjusted Standardized Residuals: expansive = -1.60; contractive = 1.60). Moreover, 44.4% of the participants in the expansive condition and 20.7% of the participants in the contractive condition found the posture to be a “facilitator” in performing the IST (Adjusted Standardized Residuals: expansive = 1.90; contractive = -1.90). Finally, 11.1% and 13.8% of the participants in the expansive and contractive conditions -respectively- found the posture to be “irrelevant” in performing the IST (Adjusted Standardized Residuals: expansive = -0.30; contractive = 0.30) (see Figure 7).

Figure 7. Percentage of participants who consider the posture to be a "facilitator", "impediment", or "irrelevant" in performing the IST in each condition.



3.6. Effect of posture on the rating of their own performance before and after the IST

There were no significant differences between conditions on rating the anticipatory performance before the IST, $t(54) = 1.81$, $p = .076$, $d = 0.48$. Participants in the expansive condition had a mean of 4.07 ($SD = 0.78$), whereas participants in the contractive condition had a mean of 3.69 ($SD = 0.81$).

Similarly, there were no significant differences between conditions on rating the overall performance after the IST, $t(54) = 0.91$, $p = .367$, $d = 0.24$. Participants in the expansive condition had a mean of 3.78 ($SD = 1.01$), whereas participants in the contractive condition had a mean of 3.52 ($SD = 1.12$).

4. Discussion

This study shows the influence of body expansiveness in the exposure to an anxiety-provoking situation in women with fear of public speaking. The objectives of the present study were to analyze the effect of an expansive (vs. contractive) posture on affect, cognitions, and exposure-related negative emotions, before and during a speech, and explore the role of the level of fear of public speaking in these relationships. Moreover, we explored whether the posture was considered a facilitator, an impediment, or irrelevant in giving the speech. Finally, we tested whether the adopted posture influenced the participants' rating of their anticipatory performance before giving a speech, as well as the overall performance after giving a speech.

The main hypothesis was partially supported. The results showed that adopting an expansive (vs. contractive) posture had effects on cognitions before and during a speech: participants in the expansive condition had fewer negative cognitions than participants in the contractive condition. Nevertheless, there were no significant differences between conditions in positive and negative affect, positive cognitions, or exposure-related negative emotions. Indeed, the results point out that the speech produces the same emotional pattern in both conditions: negative affect and exposure-related negative emotions were higher during the speech than before the speech.

Regarding the second hypothesis, it was also partially supported. The fear of public speaking did not moderate all the relationships tested between posture and affect, cognitions, or exposure-related negative emotions, before or during the speech. However, participants in the expansive (vs. contractive) condition with higher fear of public speaking (PRCS' scores around 140, on a scale ranging from 30 to 180) had lower scores on negative affect before giving the speech.

These findings suggest that, in this type of social situation, the expansive (vs. contractive) posture would have a direct effect on making individuals feel and think less negatively, but not on making them feel and think more positively. Thus, in line with Körner et al. (2015), the results indicate that bodily states could have a direct effect on individuals' feelings or information processing. These effects of the expansiveness of the posture have been also found in several studies (e.g., Cuddy et al., 2018; 2015; Nair et al., 2015) framed within the embodied cognition and emotion theories (Winkielman et al., 2015). Nevertheless, these effects were not found in the only study that has analyzed the role of posture during exposure therapy in people with SAD, carried out by Davis et al. (2017). However, in that study, the posture effect was only considered during the exposure session, and only fear was assessed, but not cognitions, affect or other exposure-related negative emotions.

By contrast, the effect of the expansive posture on negative affect before the stressful task was not found during the task. An explanation for these different results may be related to the discomfort, awkwardness, or habituation arising from adopting a posture for too long (Carney, Cuddy, & Yap, 2015). The participants held the posture for 3-5 minutes when they answered the self-report measures before the speech, but they held it for 10-15 minutes when they gave the speech and answered the self-report measures after the speech. As mentioned above, Davis et al. (2017) also failed to find significant effects of the expansive posture on fear during the stressful task. However, this study is not fully comparable with the present experiment because participants in the Davis et al. (2017) study adopted the posture only before the exposure, and the posture was somewhat different (we also emphasized the upright or stooped position of the back). Therefore, more research is needed to confirm these outcomes.

Another explanation may be related to the meaning that individuals with SAD give to a closed, stooped, and contractive posture. According to the evolutionary model of SAD (Gilbert, 2001), these individuals overuse submissive behaviors that are only adaptive in competitive environments under certain circumstances (e.g., to avoid harm or social exclusion). SAD individuals tend to consider social interactions in terms of hierarchies or competition between individuals, where they have a low status of desirable attributes, or they are at risk of losing status and control over social resources (e.g., social support). In an attempt to improve or defend their status in a competitive situation (e.g., obtain the approval of the others), they use defensive behaviors via submissive gestures (e.g., avoiding eye contact, contractive posture) to inhibit competition or threatening situations with the perceived dominant individual in the social group. Weeks et al. (2011) proved the relationship between social anxiety and two submissive gestures (contractive/stooped posture and vocal pitch peak elevation) in a competitive situation. Moreover, Langer (2015) found that individuals with SAD had higher gaze avoidance than individuals without SAD, with this being especially apparent in a conflictive situation.

Giving an impromptu speech may be considered a competitive situation because participants could pursue the approval of dominant individuals −the audience present during the speech and/or the external raters who would evaluate the quality of the speech later−. Thus, for participants in the expansive condition, preventing them from adopting a contractive posture to show submissive behavior during the speech could have been experienced as highly stressful for participants with moderate to high fear of speaking in public.

In this regard, Weeks et al. (2011) point out that adopting a contractive posture during the exposure may act as a safety behavior to overcome stressful situations. Safety

behaviors are intended to prevent or minimize feared catastrophes (Salkovskis, 1991). According to the cognitive model of Clark and Wells for SAD (Clark & Wells, 1995; Wells & Clark, 1997), one of the processes that contribute to the maintenance of the SAD is the use of safety behaviors (e.g., they keep people from experiencing the disconfirmation of beliefs about the feared catastrophes because the non-occurrence of the feared catastrophes is due to their use). Moreover, the use of safety behaviors in patients with SAD during the exposure has been related to worse outcomes (Wells et al., 1995). In this regard, CBT therapists should pay attention to the posture adopted during exposure therapy because it can act a safety behavior that minimizes the effectiveness of the exposure therapy.

This possible explanation may be corroborated by the results from the third hypothesis. No significant differences were found in considering the posture to be a facilitator, impediment, or irrelevant to performing the speech. Contrary to our hypothesis, a similar percentage of participants in both the expansive and contractive conditions considered the posture to be a facilitator or an impediment to speaking in public. One explanation for this result could be the use of categorical measures to assess this issue. Participants had to choose among three categories (facilitator, impediment, or irrelevant). Perhaps differences would have merged between conditions if participants had rated each dimension separately. However, the failure to find that the expansive posture was considered a facilitator could be also related to the "meaning" of adopting expansive or contractive postures. As mentioned before, a contractive posture may act as a safety behavior, and participants in the expansive condition may have felt like they were prevented from using this safety behavior.

Regarding the rating of the perceived performance, no significant differences were found in rating the performance before and after giving the speech (rated as "poor" and

"not so good" in general). Hence, the fourth hypothesis was not supported. This is consistent with the fact that individuals with SAD (vs. individuals without SAD) rate their own performance more negatively in social situations, even when there are no differences in the actual performance (Hofmann, 2007). Hence, it can be concluded that posture does not have a strong enough effect to change the perceived performance in individuals with moderate to high levels of fear of public speaking.

There are some limitations of the present study that should be noted. First, a non-clinical female sample participated in this study. It is especially relevant to test these effects in men as well because the expansive and contractive postures have shown different effects in women and men (Roberts & Arefi-Afshar, 2007). Moreover, it is necessary to explore these embodied effects on individuals with SAD. Nevertheless, the results of the moderation analyses are encouraging because individuals with higher fear of speaking in public benefited especially from the adoption of the expansive (vs. contractive) posture. Second, the adopted posture was only controlled by external observers. Thus, the use of body sensors that monitor the posture objectively −such as the distance between the arms and the trunk or the inclination of the upper back− would help to ensure that the posture is adopted appropriately. Third, the effects on affect and cognitions during the speech were measured retrospectively. It would have been interesting to measure other variables during the speech (e.g., the number of words spoken, the cadence of the speech, the volume of the voice) and assess the affect and cognitions after the speech. Fourth, physiological measures were not used, such as the galvanic response or the heart rate. It would be interesting to explore the possible effects of posture on the modification of autonomic changes, and test whether these changes are one of the mechanisms through which posture affects emotional and cognitive processes. Fifth, other self-report measures related to "feeling of power" that can distinguish

between feelings of personal empowerment (e.g., self-confidence, pride) and feelings of power over other individuals (e.g., dominance/control, superiority) would have helped to better understand the effects of posture before and during the exposure to this social situation. Sixth, the effect of the participants' natural posture (compared to the expansive and contractive postures) was not analyzed. It would be interesting to test whether the expansive posture has benefits over the natural posture.

This study has clinical implications. Several authors are starting to defend the need to include these experimental postural manipulations in the clinical setting as adjuvant techniques or skills in established cognitive-behavioral therapies (Folk et al., 2017). For instance, Albano and DiBartolo (2007) proposed changing the contractive posture in social interactions in the therapy for SAD. Along the same lines, Weeks et al. (2011) proposed including information about the role of body postures in psychoeducational materials for patients with SAD. However, more studies are needed to establish whether posture enhances the outcomes of exposure therapy in these patients (e.g., accelerating the extinction of the fear, improving the perception of their speaking skills, increasing adherence to therapy), or in contrast, whether the posture worsens the outcomes of the exposure (e.g., impeding the activation of the fear).

In conclusion, this study sheds light on the understudied relationship between posture and social anxiety (Gilboa-Schechtman & Shachar-Lavie, 2013). The main results of the present study show that adopting an expansive (vs. contractive) posture has positive effects on reducing negative cognitions, as well as on reducing negative affect in women with higher levels of fear. However, the benefits for self-reported negative affect were only found before giving the speech, and the adoption of the posture was considered an impediment to giving a speech by a large percentage of participants in both conditions. Taken together, the results point to the necessity of carrying out studies that explore the

effect of adopting an expansive (vs. contractive) posture only before the stressful situation for a short period of time. We suggest that adopting an expansive posture *before* the stressful situation may act as an inducer of empowerment towards oneself in dealing with a social situation. However, adopting an expansive posture *during* the stressful situation may have negative consequences because it can be experienced as pretending to be more powerful than others in a social situation. Nevertheless, more research is needed in order to disentangle whether avoiding a contractive posture or promoting an expansive posture has positive therapeutic outcomes before or during exposure to an anxiety-provoking situation.

5. References

Albano, A. M., & DiBartolo, P. M. (2007). *Cognitive-Behavioral Therapy for Social Phobia in Adolescents: Stand Up, Speak Out Therapist Guide*. New York: Oxford University Press.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Arlington, VA: American Psychiatric Association.

Bados, A. (1986). *Análisis de componentes de un tratamiento cognitivo-somático-conductual del miedo a hablar en público* [Analysis of components of a cognitive-somatic-behavioral treatment of fear of public speaking]. Unpublished doctoral dissertation, University of Barcelona, Barcelona.

Bandelow, B., & Michaelis, S. (2015). Epidemiology of anxiety disorders in the 21st century. *Dialogues in clinical neuroscience, 17*(3), 327-335.

Baños, R. M., Belloch, A., & Perpina, C. (1990). Self-consciousness Scale: A study of Spanish housewives. *Psychological Reports*, *66*(3), 771-774. doi: 10.2466/pr0.1990.66.3.771

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology, 59*, 617–645. doi:10.1146/annurev.psych.59.103006.093639

Beidel, D. C., Turner, S. M., Jacob, R. G., & Cooley, M. R. (1989). Assessment of social phobia: Reliability of an impromptu speech task. *Journal of anxiety disorders, 3*(3), 149-158. doi: 10.1016/0887-6185(89)90009-1

Bobes, J., Badía, C., Luque, A., García, M., González, M. P., & Dal-Ré, R. (1999). Validación de las versiones en español de los cuestionarios Liebowitz Social Anxiety Scale, Social Anxiety and Distress Scale y Sheehan Disability Inventory para la evaluación de la fobia social [Validation of the Spanish versions of the Liebowitz Social Anxiety Scale, Social Anxiety and Distress Scale and Sheehan Disability Inventory for the evaluation of social phobia]. *Medicina Clínica*, *112*, 530-538.

Briñol, P., Petty, R. E., & Wagner, B. (2009). Body posture effects on self-evaluation: A self-validation approach. *European Journal of Social Psychology*, *39*(6), 1053–1064. doi: 10.1002/ejsp.607

Carney, D. R., Cuddy, A. J., & Yap, A. J. (2010). Power posing brief nonverbal displays affect neuroendocrine levels and risk tolerance. *Psychological Science*, *21*(10), 1363–1368. doi:10.1177/0956797610383437

Carney, D. R., Cuddy, A. J., & Yap, A. J. (2015). Review and summary of research on the embodied effects of expansive (vs. contractive) nonverbal displays. *Psychological Science*, *26*(5), 657–663. doi:10.1177/0956797614566855

Clark, D. M. & Wells, A. (1995). A cognitive model of social phobia. In R. Heimberg, M. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment and treatment* (pp. 69–93). New York: Guilford Press.

Cuddy, A. J., Schultz, S. J., & Fosse, N. E. (2018). P-Curving a More Comprehensive Body of Research on Postural Feedback Reveals Clear Evidential Value For Power-Posing Effects: Reply to Simmons and Simonsohn (2017). *Psychological science*, 0956797617746749. doi: 10.1177/0956797617746749

Cuddy, A. J., Wilmuth, C. A., Yap, A. J., & Carney, D. R. (2015). Preparatory power posing affects nonverbal presence and job interview performance. *Journal of Applied Psychology*, *100*(4), 1286. doi:10.1037/a0038543

Davis, M. L., Papini, S., Rosenfield, D., Roelofs, K., Kolb, S., Powers, M. B., & Smits, J. A. (2017). A randomized controlled study of power posing before public speaking exposure for social anxiety disorder: No evidence for augmentative effects. *Journal of anxiety disorders*, *52*, 1-7. doi: 10.1016/j.janxdis.2017.09.004

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, *39*(2), 175-191.

Feske, U., & Chambless, D. L. (1995). Cognitive behavioral versus exposure only treatment for social phobia: A meta-analysis. *Behavior therapy*, *26*(4), 695-720. doi: 10.1016/S0005-7894(05)80040-1

Folk, J. B., Disabato, D. J., Goodman, F. R., Carter, S. P., DiMauro, J. C., & Riskind, J. H. (2017). Wise additions bridge the gap between social psychology and clinical practice: Cognitive-behavioral therapy as an exemplar. *Journal of psychotherapy integration, 27*(3), 407-423.doi: 10.1037/int0000038

Furmark, T. (2002). Social phobia: overview of community surveys. *Acta Psychiatrica Scandinavica*, *105*(2), 84-93. doi: 10.1034/j.1600-0447.2002.1r103.x

Gallego, M.J., Botella, C., Quero, S., Baños, R.M., & Garcia-Palacios, A. (2007). Psychometric properties of the Brief version of the Fear of Negative Evaluation Scale (BFNE) in a clinical sample. *Revista de Psicopatología y Psicología Clínica, 12*, 163-176

Gallego, M.J., Botella, C., Quero, S., Garcia-Palacios, A., & Baños, R.M., (2009). Validación del "Cuestionario de confianza para hablar en público" en una muestra clínica española [Validation of the "Confidence Questionnaire for Public Speaking" in a Spanish clinical sample]. *Behavioral Psychology*, *17*(3), 416-431.

Garrison, K. E., Tang, D., & Schmeichel, B. J. (2016). Embodying power: A preregistered replication and extension of the power pose effect. *Social Psychological and Personality Science*, *7*(7), 623-630. doi: 10.1177/1948550616652209

Gilbert, P. (2001). Evolution and social anxiety: The role of attraction, social competition, and social hierarchies. *Psychiatric Clinics*, *24*(4), 723-751. doi: 10.1016/S0193-953X(05)70260-4

Gilboa-Schechtman, E., & Shachar-Lavie, I. (2013). More than a face: a unified theoretical perspective on nonverbal social cue processing in social anxiety. *Frontiers in human neuroscience, 7*, 904. doi: 10.3389/fnhum.2013.00904

Gronau, Q. F., Van Erp, S., Heck, D. W., Cesario, J., Jonas, K. J., & Wagenmakers, E. J. (2017). A Bayesian model-averaged meta-analysis of the power pose effect with informed and default priors: the case of felt power. *Comprehensive results in social psychology*, *2*(1), 123-138. doi: 10.1080/23743603.2017.1326760

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Heimberg, R. G. (2002). Cognitive-behavioral therapy for social anxiety disorder: current status and future directions. *Biological psychiatry*, *51*(1), 101-108. doi: 10.1016/S0006-3223(01)01183-0

Hofmann, S. G. (2007). Cognitive factors that maintain social anxiety disorder: A comprehensive model and its treatment implications. *Cognitive behaviour therapy*, *36*(4), 193-209. doi: 10.1080/16506070701421313

Hofmann, S. G., & DiBartolo, P. M. (2000). An instrument to assess self-statements during public speaking: Scale development and preliminary psychometric properties. *Behavior Therapy*, *31*(3), 499-515. doi: 10.1016/S0005-7894(00)80027-1

Hofmann, S. G., Wu, J. Q., & Boettcher, H. (2013). D-Cycloserine as an augmentation strategy for cognitive behavioral therapy of anxiety disorders. *Biology of mood & anxiety disorders*, *3*(1), 11. doi: 10.1186/2045-5380-3-11

Körner, A., Topolinski, S., & Strack, F. (2015). Routes to embodiment. *Frontiers in Psychology*, *6*. doi: 10.3389/fpsyg.2015.00940

Langer, J. (2015). *Eye Contact and Social Anxiety Disorder* (Published dissertation). Arts & Sciences Electronic Theses and Dissertations. 561. Washington University, St. Louis. http://openscholarship.wustl.edu/art_sci_etds/561

Leary, M. R. (1983). A brief version of the Fear of Negative Evaluation Scale. *Personality and Social Psychology Bulletin*, *9*(3), 371-375. doi: 10.1177/0146167283093007

Mayo-Wilson, E., Dias, S., Mavranezouli, I., Kew, K., Clark, D. M., Ades, A. E., & Pilling, S. (2014). Psychological and pharmacological interventions for social anxiety disorder in adults: a systematic review and network meta-analysis. *The Lancet Psychiatry*, *1*(5), 368-376. doi: 10.1016/S2215-0366(14)70329-3

Méndez, F.X., Inglés, C. J., & Hidalgo, M. D. (1999). Propiedades psicométricas del Cuestionario de Confianza para Hablar en Público: Estudio con una muestra de alumnos de enseñanzas medias [Psychometric properties of the Confidence Questionnaire for Public Speaking: Study with a sample of middle school students]. *Psicothema*, *11*(1), 65-74.

Michalak, J., Mischnat, J., & Teismann, T. (2014). Sitting posture makes a difference—embodiment effects on depressive memory bias. *Clinical Psychology & Psychotherapy*, *21*(6), 519–524. doi: 10.1002/cpp.1890

Nair, S., Sagar, M., Sollers III, J., Consedine, N., & Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology*, *34*(6), 632. doi:10.1037/hea0000146

Niedenthal, P. M. (2007). Embodying emotion. *Science*, *316*(5827), 1002–1005. doi:10.1126/science.1136930

Paul, G. (1966). *Insight vs. desensitization in psychotherapy*. Palo Alto, CA: Stanford University Press.

Piedmont, R. L. (2014). Inter-item correlations. In Michalos, A.C (Ed.), *Encyclopedia of quality of life and well-being research.* Netherlands: Springer.

Ponniah, K., & Hollon, S. D. (2008). Empirically supported psychological interventions for social phobia in adults: a qualitative review of randomized controlled trials. *Psychological medicine*, *38*(1), 3-14. doi: 10.1017/S0033291707000918

Ranehill, E., Dreber, A., Johannesson, M., Leiberg, S., Sul, S., & Weber, R. A. (2015). Assessing the robustness of power posing: No effect on hormones and risk tolerance in a large sample of men and women. *Psychological Science*, *26*(5), 653–656. doi: 10.1177/0956797614553946

Rivero, R., Garcia-Lopez, L., & Hofmann, S. G. (2010). The Spanish Version of the Self-Statements During Public Speaking Scale. *European Journal of Psychological Assessment, 26,* 129-135. doi: 10.1027/1015-5759/a000018.

Roberts, T. A., & Arefi-Afshar, Y. (2007). Not all who stand tall are proud: Gender differences in the proprioceptive effects of upright posture. *Cognition and Emotion, 21*(4), 714-727. doi: 10.1080/02699930600826432

Ruscio, A. M., Brown, T. A., Chiu, W. T., Sareen, J., Stein, M. B., & Kessler, R. C. (2008). Social fears and social phobia in the USA: results from the National Comorbidity Survey Replication. *Psychological medicine, 38*(1), 15-28. doi: 10.1017/S0033291707001699

Saghaei, M. (2004). Random allocation software for parallel group randomized trials. *BMC medical research methodology*, *4*(1), 26.

Salkovskis, P. (1991). The importance of behaviour in the maintenance of anxiety and panic: A cognitive account. *Behavioural Psychotherapy, 19*, 6–19. doi: 10.1017/S0141347300011472

Sandín, B., Chorot, P., Lostao, L., Joiner, T. E., Santed, M. A., & Valiente, R. M. (1999). Escalas PANAS de afecto positivo y negativo: validación factorial y convergencia transcultural [PANAS scales of positive and negative affect: factorial validation and transcultural convergence]. *Psicothema*, *11*(1), 37-51.

Scheier, M. F., & Carver, C. S. (1985). The self-consciousness scale: A revised version for use with general populations. *Journal of Applied Social Psychology*, *15*(8), 687-699. doi: 10.1111/j.1559-1816.1985.tb02268.x

Simmons, J. P., & Simonsohn, U. (2017). Power posing: P-curving the evidence. *Psychological Science*, *28*(5), 687–693. doi: 10.1177/0956797616658563

Stein, M. B., & Stein, D. J. (2008). Social anxiety disorder. *The Lancet*, *371*(9618), 1115-1125. doi: 10.1016/S0140-6736(08)60488-2

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of personality and social psychology*, *54*(6), 1063. doi: 10.1037/0022-3514.54.6.1063

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of consulting and clinical psychology*, *33*(4), 448-457. doi: 10.1037/h0027806

Weeks, J. W., Heimberg, R. G., & Heuer, R. (2011). Exploring the role of behavioral submissiveness in social anxiety. *Journal of Social and Clinical Psychology*, *30*(3), 217-249. doi: 10.1521/jscp.2011.30.3.217

Wells, A. & Clark, D. M. (1997). Social phobia: A cognitive approach. In G. C. L. Davey (Ed.), *Phobias: A handbook of description, treatment and theory* (pp. 3–26). Chichester, Sussex: Wiley.

Wells, A., Clark, D. M., Salkovskis, P., Ludgate, J., Hackmann, A., & Gelder, M. G. (1995). Social phobia: The role of in-situation safety behaviors in maintaining anxiety and negative beliefs. *Behavior Therapy*, *26*, 153–161. doi: 10.1016/S0005-7894(05)80088-7

Winkielman, P., Niedenthal, P., Wielgosz, J., Eelen, J., & Kavanagh, L.C. (2015). Embodiment of cognition and emotion. In M. Mikulincer, P.R. Shaver, E. Borgida, J.A. Bargh (Eds.), *APA handbooks in psychology. APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 151-175). Washington, DC, US: American Psychological Association.

CHAPTER 3. Study 2

Expand your body when you look at yourself: The role of the posture in a mirror exposure task

---

This chapter is published as: Miragall, M., Etchemendy, E., Cebolla, A., Rodríguez, V., Medrano, C., & Baños, R.M. (2018). Expand your body when you look at yourself: The role of the posture in a mirror exposure task. PLoS ONE 13(3): e0194686. https://doi.org/10.1371/journal.pone.0194686

Abstract

Mirror exposure (ME) is one of the main components of the treatment of patients with eating disorders symptomatology and it has shown its effectiveness in improving several outcomes (e.g., body dissatisfaction). However, the study as to what body posture should be adopted to maximize its effectiveness has been neglected. From embodied cognition and emotion theories, the adoption of an expansive (vs. contractive) body posture has been associated with positive changes in cognitive and emotional responses. The objective of this study was to analyze the effect of adopting an expansive (vs. contractive) posture before an ME task on body-related emotions and cognitions, as well as to analyze the possible moderator and mediator variables of these relationships. The sample was composed of 68 women (age: M = 21.74, SD = 3.12) with high scores on body dissatisfaction. Participants were randomly assigned to the expansive or contractive condition, where the openness of the arms/legs and the back position were manipulated. Posture was monitored by an electronic device and participants filled out several self-reported measures. ANCOVAs, moderation, mediation, and moderated mediated analyses were performed. Results showed that women in the expansive condition showed higher positive emotions after the ME. Moreover, exploratory analyses showed that adopting an expansive posture improved positive emotions, leading to improvements in negative emotions, body image satisfaction, and appraisal of the person's own body. Psychological interventions should explore the value of holding an expansive posture before the ME in women with body dissatisfaction.

Keywords: embodied cognition; posture; expansive; mirror exposure; body dissatisfaction

1. Introduction

Body dissatisfaction has been defined as the negative subjective evaluation of one's physical body, and it has been identified as a risk and maintenance factor for eating disorders (ED)[5], such as anorexia and bulimia nervosa (Stice, 2002). In fact, evidence indicates that individuals with ED symptomatology show negative emotional and cognitive responses, as well as changes in physiological responses, when they are exposed to their own bodies (Ortega-Roldán, Rodríguez-Ruíz, Perakakis, Fernández-Santaella, & Vila, 2014; Tuschen-Caffier, Vögele, Bracht, & Hilbert, 2003; Vocks, Legenbauer, Wätcher, Wicherer, & Kosfelder, 2007).

Mirror exposure (ME), based on the behavioral principles of exposure therapy, is a relevant component in the treatment of patients with body dissatisfaction. It generally consists of observing and describing each part of the person's own body in a full-length mirror for a long period of time while wearing tight fitting clothes (Koskina, Campbell, & Schmidt, 2013). ME has been shown to be effective in improving several important outcomes (e.g., dissatisfaction, negative body-related emotions and cognitions, or other aspects of ED psychopathology) in clinical samples with ED (e.g., Hildebrandt, Loeb, Troupe, & Delinsky, 2012; Trentowska, Svaldi, & Tuschen-Caffier, 2014; Díaz-Ferrer, Rodríguez-Ruíz, Ortega-Roldán, Moreno-Domínguez, & Fernández-Santaella, 2015), as well as in non-clinical samples (e.g., Díaz-Ferrer, Rodríguez-Ruíz, Ortega-Roldán, Moreno-Domínguez, Mata-Martín, & Fernández-Santaella, 2017; Luethcke, McDaniel, & Becker, 2011).

[5] *Abbreviations:* ED = Eating Disorders; ME = Mirror Exposure; BSQ = Body Shape Questionnaire; EAT-26 = The Eating Attitudes Test-26; TCL = Thoughts Checklist; VAS = Visual Analogue Scale; BISS = Body Image States Scale; IMU = Inertial Measurement Unit.

Several changes in the ME procedure have been applied varying, for instance, the descriptions individuals should make or the body part where the attention should be focused. Regarding descriptions, some studies have demonstrated the effectiveness of the ME procedure even without making them (that is, only observing the body) (Key et al., 2002; Vocks et al., 2007), making non-judgmental or neutral descriptions (Delinsky & Wilson, 2006; Hildebrandt et al., 2012), or making positive descriptions (Luethcke et al., 2011). Regarding where the attention is focused, Jansen et al. (2016) showed that ME, focused on self-defined attractive or self-defined unattractive body parts, was equally effective, leading to improvements in body satisfaction. However, the study about which body posture should be adopted in the ME in order to maximize its effectiveness has been neglected.

Some studies have evidenced the link between the body posture and the body image concerns. Galeazzi, Monzani, Gherpelli, Covezzi, and Guaraldi (2006) have showed that the postural control during an ME task was significantly inversely related to the body image concerns in healthy participants. In this line, Forghieri et al. (2016) found that when ED patients (compared to healthy participants) were exposed to their own body or images of thin ideal models, they showed greater postural destabilization. Moreover, Kolnes (2012) described a disturbance in the posture besides the postural control in patients with anorexia nervosa, concluding that, among other characteristics, their posture tends to be stooped (e.g., the head and the shoulders are pulled forward).

Embodied cognition and emotion theories have highlighted the role of bodily states (e.g., sensor or motor states) in shaping cognition and emotion (Barsalou, 2008; Niedenthal, 2007; Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015). Specifically, the adoption of an expansive (vs. contractive) or an upright (vs. stooped) posture have been related to positive changes in emotional, cognitive, behavioral, and

physiological responses, such as: increased feelings of power and risk-taking behavior, and hormonal changes associated with more dominance and less stress (Carney, Cuddy, & Yapp, 2010); better nonverbal behavior (e.g., more confident) during a stressful job interview that led to a better overall performance (Cuddy, Wilmuth, Yap, & Carney, 2015); higher self-esteem, more arousal, more positive mood, and less fear during a stressful speech task (Nair, Sagar, Sollers, Consedine, & Broadbent, 2015); or more confidence in the self-attributes that individuals generated about their potential professional success (Briñol, Petty, & Wagner, 2009). Specifically, in the field of body dissatisfaction, Allen, Gervais, and Smith (2013) showed that women with high body dissatisfaction who were seated in an expansive (vs. contractive) posture attenuated the robust link between body dissatisfaction and restrained eating. Moreover, a recent Bayesian meta-analysis of preregistered studies found evidence for the effect of expansive postures (or "power posing") on increasing self-reported felt power (Gronau et al., 2017).

Despite the positive effects of expansive or upright (vs. contractive or stooped) postures on emotional and cognitive processes, no studies have analyzed the effect of adopting a specific posture in ME. Hence, the main objective of this study is to analyze the effect of adopting an expansive and upright (vs. contractive and stooped) posture for a short period of time before the ME on body-related emotions and cognitions: body- and eating-related negative thoughts during ME, as well as emotions, body image satisfaction (that is, the evaluative/affective experience related to one's physical appearance), and appraisal of the person's own body description after ME. Additionally, we developed an electronic device to monitor the posture before the ME task in order to ensure that women in each condition hold the appropriate posture objectively. The second aim of this study is to explore the more salient emotions felt by the participants while they were holding

each posture. Moreover, the third aim is to analyze the role of the Body Mass Index (BMI) as a moderator on the effect of posture in changing body-related emotions and cognitions (negative thoughts during ME, as well as emotions, body image satisfaction, and the appraisal of the person's own body after ME). Finally, the fourth and last aim is to explore possible mediators of the effects of posture on body-related emotions and cognitions after ME.

It is expected that the manipulation of the posture before the exposure to the person's own body would act as a "positive state inductor" that would help to enhance the body-related emotions and cognitions in an ME task. This assumption is based on one of the mechanism of embodied cognition effects proposed by Körner, Topolinski, & Strack (2015), in which bodily states may directly alter the individual's feelings or information processing. Hence, the first hypotheses is that adopting an expansive (vs. contractive) posture would have positive effects on body-related emotions and cognitions (e.g., lower negative thoughts during ME, higher body image satisfaction after ME). The second hypothesis states that a greater percentage of women holding an expansive (vs. contractive) posture would feel positive emotions (e.g., self-confidence), whereas a greater percentage of women holding a contractive (vs. expansive) posture would feel negative emotions (e.g., insecurity). Moreover, the third hypothesis is that the BMI would moderate the effect of posture on changing body-related emotions and cognitions (e.g., women with lower BMI would achieve higher body image satisfaction after ME when adopting an expansive posture). This hypothesis is based on the meta-analysis by Stice (2002), in which elevated BMI was identified as a risk factor for perceived pressure to be thin or for increased body dissatisfaction. Finally, no specific hypotheses are generated for the mechanisms of change that mediate the effect of posture on body-related emotions and cognitions due to the exploratory nature of the analyses.

2. Method

2.1. Participants

The sample was composed of 68 female students from the University of Valencia. The mean age was 21.74 (*SD* = 3.12), ranging from 18 to 35, and the average BMI was 22.60 (*SD* = 2.66), ranging from 18.20 to 29.61. The sample size was determined using *G*Power* (Faul, Erdfelder, Lang, & Buchner, 2007), and a total of 34 participants per group were estimated to be included in the sample to detect a moderate effect size of *Cohen's d* = 0.60 on the primary outcomes, taking into account the effect size found in other studies regarding the effect of posture manipulation on feelings of power, positive emotions, or self-esteem (e.g., Carney et al., 2010, Nair et al., 2015), an alpha error of .05, and a statistical power of .80. The eligibility criteria for the present study included an age between 18 and 35 years, to reach a cut-off of ≥ 81 in the *Body Shape Questionnaire* (BSQ, Cooper, Taylor, Cooper, & Fairburn, 1987) (a mild or more body dissatisfaction according to Cooper and Taylor, 1988), and to have a BMI between 18.0 and 29.9 (to ensure that the body dissatisfaction is not due to excessive weight). The exclusion criteria were: (a) being currently under psychological treatment; (b) having a clinical history of ED; (c) being pregnant; and (d) reaching a cut-off ≥ 20 in the Eating Attitudes Test-26 (EAT-26, Garner, Olmsted, Bohr, & Garfinkel, 1982) (to include participants without high ED symptomatology).

The screening questionnaires were completed by 491 women, but only 135 women met the participation criteria. They were invited to participate by phone, 23 participants did not respond to the call, 33 declined to participate in the experiment, and 11 did not came to the laboratory appointment. Finally, 68 women participated in the study and they were randomized. All participants signed informed consent documents before filling out the screening questionnaires and starting the experiment, in accordance with the

Declaration of Helsinki. Moreover, the Ethics Committee at the University of Valencia approved the study.

2.2. Measures and Materials

2.2.1. Demographic, medical, and psychological variables. An *ad-hoc* questionnaire was made to collect information regarding: age, weight, height, pregnancy, or psychological treatments.

2.2.2. Trait body dissatisfaction: Body Shape Questionnaire (BSQ; Cooper et al., 1987). This is a 34-item self-report questionnaire that assesses the dissatisfaction produced by one's own body, the fear of gaining weight, self-devaluation due to physical appearance, desire to lose weight, and avoidance of situations in which physical appearance could attract the attention of others. Items are rated on a 6-point Likert scale, ranging from 1 (never) to 6 (always). The total score is the composite addition of the items (ranging from 34 to 204), and higher scores indicate higher body dissatisfaction in the past four weeks. According to Cooper and Taylor (1988), the scores can be grouped in four categories or levels of concern: "no concern" (< 81), "mild concern" (81–110), "moderate concern" (111–140), and "extreme concern" (>140). The Spanish validation of the questionnaire was used (Raich et al., 1996). This validation showed an adequate internal consistency in different non-clinical samples (α ranging from .95 to .97). In the present study, the internal consistency was also adequate (α = .84).

2.2.3. Symptoms of ED: The Eating Attitudes Test-26 (EAT-26; Garner et al., 1982). This is a 26-item self-report questionnaire to be rated on a 6-point Likert scale

ranging from 1 (never) to 6 (always). The total score is the composite addition of the items ranging from 0 to 78, that reflect the symptoms and concerns characteristic of ED. The scores for three subscales can also be calculated: (1) Dieting (items including avoidance of fattening foods and shape concerns); (2) Bulimia and Food Preoccupation (items including bulimic behaviors, and thoughts about food); and (3) Oral Control (items including self-control about intake and social pressure by the others to gain weight). The original authors of the questionnaire recommended the score ≥ 20 as a cut-off that indicates a high level of concern about dieting, body weight or problematic eating behaviors. The Spanish validation of the questionnaire (Gandarillas, Zorrilla, Sepúlveda, & Muñoz, 2003) was used. This validation showed an adequate internal consistency in a non-clinical population (α = .86). In the present study, the internal consistency was adequate for the total score (α = .78).

2.2.4. Body- and eating-related negative thoughts during the ME task: Thoughts Checklist (TCL; Cooper & Fairburn, 1992). This checklist consists of 17 statements representing typical body-related negative thoughts (e.g., "I can't look at myself in this mirror") and eating-related negative thoughts (e.g., "I'll go away and eat") that people with ED have during the ME task. Items should be rated by the frequency of their occurrence (1 = thought did not occur; 6 = thought was there all the time), and a sum of negative cognitions frequency score is computed, ranging from 17 to 102. The Spanish version, translated by the authors, was used and it showed an adequate internal consistency (α = .82).

2.2.5. Negative and Positive Emotions: Emotions' Scale (ES). A ES was used based on previous studies (e.g., Tuschen-Caffier et al., 2003; Trentoska, Bender, & Tuschen-Caffier, 2013; Vocks et al., 2007). Six negative emotions (shame, sadness,

anger, insecurity, disgust, and anxiety) (negative ES) and two positive emotions (happiness and self-confidence) (positive ES) that may occur during the ME task were chosen by the authors. Participants had to rate to what extent they felt each emotion on a 7-point Likert scale (1 = nothing; 7 = completely) before and after the ME. Since the inter-item correlations for positive ES and negative ES were adequate ($r > .20$) according to Piedmont (2014), two separate scores were calculated for positive and negative ES scores in order to reduce the probability of type I error. The internal consistency was adequate for negative ES across the administrations (α ranging from .78 to .88) and for positive ES at post-ME (α = .75), except for positive ES at pre-ME (α = .55).

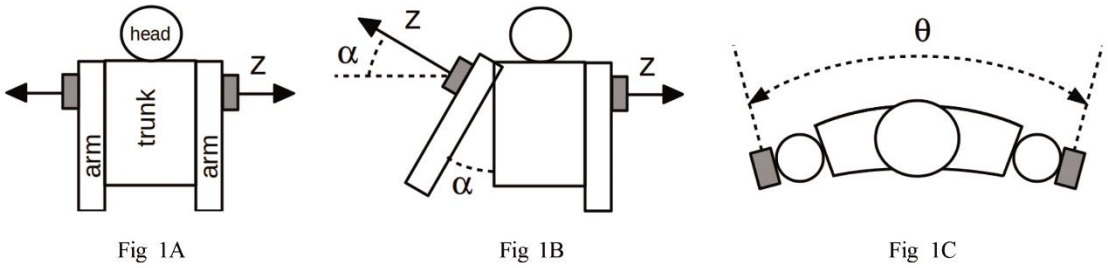
2.2.6. State body image: Body Image States Scale (BISS, Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002). This is a 6-item self-report questionnaire that measures the individuals' evaluation and affect about their physical appearance (e.g., body image appraisal and satisfaction, as well as emotional experiences) at a particular moment in time: (1) satisfaction with one's overall physical appearance, (2) satisfaction with one's body size and shape, (3) satisfaction with one's weight; (4) feelings of physical attractiveness; (5) current feelings about one's looks relative to how one usually feels; and (6) evaluation of one's appearance relative to how the average person looks. Items are rated on a 9-point bipolar Likert scale. The measure is the composite mean of the items, and higher scores reflect more favorable body image satisfaction state. The BISS was acceptably internally consistent in the original validation. A Spanish version, translated by the authors, was used and it showed an adequate internal consistency across all administrations (α ranging from .81 to .87).

2.2.7. Appraisal of the person's own body descriptions. An *ad-hoc* questionnaire was developed. Participants had to appraise the adjectives that they used to

describe their own body during the ME task as negative, neutral, or positive (e.g., "For me, that my hair is _____ is…"). They were asked to rate the two adjectives for 15 parts of their body (e.g., hair, buttocks) in an 11-point bipolar Likert scale (-5 = negative appraisal; 0 = neutral appraisal; +5 = positive appraisal). The total score was calculated by the mean from all the items. The internal consistency for this questionnaire was adequate ($\alpha = .79$).

2.2.8. Electronic device to monitor posture. An electronic measurement device was built around an inertial measurement unit (IMU MPU9255) connected to a microcontroller with a Bluetooth module. The set was mounted inside a small plastic box. An IMU includes an accelerometer, a magnetometer, and a gyroscope. It allows for the obtaining of the relative orientation of the IMU axes (x-y parallel to the IMU plane and z perpendicular to it) with respect to the earth's axes (north, west, and vertical). In the experiment, the box was attached to the upper arm with an elastic strip. In the rest position, the IMU z-axis was approximately in the frontal human body plane (see Figure 1A). From the rest position, the angle of the box with the vertical was measured (see Figure 1B), as an estimation of the angle between the upper arm and the trunk (α). To reduce the number of parameters, and to facilitate posterior visualization, the mean angle of the left and right arms was obtained. In addition, if the chest was expanded by a movement of the shoulder blades, the devices were rotated and the angle between them on the horizontal plane was also measured (θ) (see Figure 1C). Both, α and θ were calibrated at the rest position, so that those initial angles were subtracted from the posterior measurements. During the experiments, the sensor sent values at 1 Hz to a PC with a Bluetooth port.

Figure 1. Schematic representation of the angles measured with the device.



Note. Fig 1A = rest position (front view); Fig 1B = arm separated from trunk (front view); Fig 1C = chest expansion (top view).

2.3. The ME task

The ME task carried out in this study was based on the procedure followed by Luethcke et al. (2011) and Delinsky and Wilson (2006). Participants had to observe their own bodies in a three-way mirror and describe different parts of their body. To do so, participants had to make two comments on 15 parts of their body in the following order: hair, skin, eyes, nose, mouth, neck, arms, chest, waist, hips, buttocks, thighs, calves, ankles, and feet. An audio file was recorded, including the 15 parts of the body, with the following standardized instructions: (1) Focus on your _____ (e.g., hair); (2) Make two comments about your _____ (e.g., hair). The participants must focus their attention for 10 seconds on the specific part of the body, and then, they had up to 25 seconds to make the two descriptions of the specific part of the body. They were asked not to focus on other parts of the body until the next instruction was given. The task lasted 10 minutes approximately.

Regarding the descriptions, the only instruction that was given to the participants is that the description of their body should be related to the physical appearance (e.g., shape,

length, width, symmetry, coloring). Moreover, the researcher recommended to the participants that they should make the comments while keeping in mind that they could not be seen and that their image would be drawn according to their descriptions. Because of that, they should avoid evaluative comments or subjective terms, such as "beautiful" or "ugly", or "I like it" or "I don't like it". The researcher checked the complete understanding of the task before starting, requesting an example of the description of their hand (a part not included in the task).

Participants should have a complete view of their own bodies in the three-way mirror. Thus, they had to remain on a mark placed on the floor in front of the mirror. However, they could move to get a better view of some parts of their own body (e.g., to look at their buttocks). Before beginning the task, to make the own view of the body similar for all the participants, they were requested to put on grey cotton leggings and a grey cotton short-sleeve t-shirt in a size that best fitted the participant.

A researcher remained in the room while the participant did the ME task, but the researcher was out of the participant's view, not looking at her. The researcher wrote down all the descriptions that the participants made about their body parts. The researcher only spoke to the participants if they skipped the comments they should make. Moreover, the researcher reminded them the kind of description that they could make if they got stuck in a body part or if they used evaluative comments.

2.4. Procedure

The sample was recruited from both the Psychology and the Speech Therapy degree programs at the University of Valencia, where researchers invited the students to participate in a study related to "body image and the validation of body motion sensors". Notices were also placed on several bulletin boards in the Faculty of Psychology. Once

the participants expressed a wish to participate, they filled out the informed consent and the screening questionnaires (*ad-hoc* questionnaire, BSQ and EAT-26). Only participants who met the inclusion and exclusion criteria were invited to participate by a phone call or e-mail. They were informed that it was mandatory not to eat or perform intense physical activity in the 2 hours before coming to the laboratory in order to standardize feelings of fatness, and they were informed that the researcher was going to ask them to change their clothes during the experiment.

Participants were randomly assigned to the expansive (n = 34) or contractive (n = 34) condition using the Random Allocation Software 2.0 (Saghaei, 2004). No participants were excluded. When participants came to the laboratory, they filled out the ES and the BISS. Then, the researcher left the room to allow the participants to change their clothes. Next, the electronic measurement devices were placed on both upper arms, and the researcher asked the participants to stay in a neutral posture (upright, with arms extended and close to the trunk) for one minute to calibrate the body (see Figure 2A). Subsequently, the ME task was explained to the participants, but the researcher told the participants that it was necessary to do a new calibration of the body sensor before starting the task (to cover the main objective of the study).

The posture was manipulated following the previous studies (Carney et al., 2010; Cuddy et al., 2015; Michalak, Mischnat, & Teismann, 2014), where the expansiveness or openness (keeping arms and legs open or closed), as well as the position of the back (upright or slumped) were manipulated. The decision to make the participants hold the posture only before the ME (not during) and for a short period of time (2 minutes) is based on the study by Carney et al. (2010) and the conclusions of the review by Carney, Cuddy, and Yap (2015), that suggested that the length of time that the posture is adopted should be carefully considered because it seems to be an important moderator variable

responsible for the contradictory results found in the effects of posture (e.g., holding some postures for a long time might cause discomfort or habituation). In addition, Ortega-Roldán, Rodríguez-Ruiz, Díaz-Ferrer, Fernández-Santaella, and Vila (2014) found that women with high body dissatisfaction (compared to women with low body dissatisfaction) that were exposed to photographs of their own body in model postures (upright position with one hand on the waist and the other extended, and one knee slightly flexed) compared to neutral postures (upright position with arms extended and close to the trunk) showed less pleasure, more negative and ugliness feelings, and an increased startle response (a reflex that is potentiated when processing stimuli associated with negative affect). Moreover, the decision to manipulate the women's backs as well as to expand the body, is based on the positive results that the upright postures have shown (e.g., Briñol et al., 2009; Nair et al., 2015).

The experimenter gave the instructions verbally, modelled the posture, and showed a photo of the posture to the participants. In the expansive condition, participants had to adopt an expansive, upright, and open posture (standing up, with the chest out, shoulders back and the back straight, chin parallel to floor, arms at hips, and legs slightly open) (see Figure 2B). In contrast, in the contractive condition, participants had to adopt a contractive, stooped, and closed posture, taking up less space (standing up, with stooped back, dropping the rib cage with shoulders forward, neck slightly down, and hands and legs together and intertwined) (see Figure 2C).

After adopting the posture for 2 minutes, participants were placed in front of the mirror adopting a free posture. Once the task was finished, they completed the TCL, the ES, the BISS, and the questionnaire about the appraisal of the person's own body descriptions. We also requested the participants to choose one emotion (self-confidence, aplomb, dignity, arrogance, pride, submissiveness, sadness, and insecurity) that best

reflected their experience in the adopted posture. Moreover, they were weighed on a weighing scale. At the end of the experiment, we interrogated each participant to make sure that they had not discovered the hypothesis of the study. No participants guessed the deception involved in the posture manipulation or the connection between the effects of posture on the body-related emotions and cognitions. The experiment lasted 45 minutes approximately and participants were given €5 for their participation.

Figure 2. Postures adopted during the experiment.

Fig 2A

Fig 2B

Fig 2C

Note. Fig 2A = Neutral posture (for calibrating); Fig 2B = Expansive posture; Fig 2C = Contractive posture.

2.5. Data Analyses

Statistical analyses were performed using the SPSS v.24 software. Regarding the posture manipulation (measured by an electronic device), after the manipulation of the posture for 2 minutes, the mean values of α and θ were represented (see Figure 1B and Figure 1C). One of the points was removed as an outlier. It was visually apparent that these angles were different depending on the kind of posture adopted. To characterize it with a single value, a linear discriminant analysis was performed. The line that separated the two classes was obtained and the signed distance to it was used as a feature related to expansive posture (see Figure 3). Moreover, an independent-sample t-test was performed to test whether there were significant differences in this value [6].

Regarding the analyses in self-measures, firstly, descriptive statistics and four independent-samples t-test were performed to verify that there were no significant differences in age, BMI, BSQ, EAT-26 at baseline across conditions. Secondly, eleven ANCOVAs (with the condition as between-factor and baseline scores as covariates) and two independent-samples t-test were performed to check the effects of the posture on BISS, negative and positive ES, TCL, and appraisal of the person's own body description.

Thirdly, to analyze the differences in the percentage of emotions felt in each condition, a chi-square test was performed, using Monte Carlo with 10,000 samples and a 99% of level of confidence. When the absolute value of the Adjusted Standarized Residual was greater than 1.96, the relationship between the different categories was considered significant, and the sign indicated the type of relationship between the categories.

Finally, five moderation analyses and three mediation analysis were performed

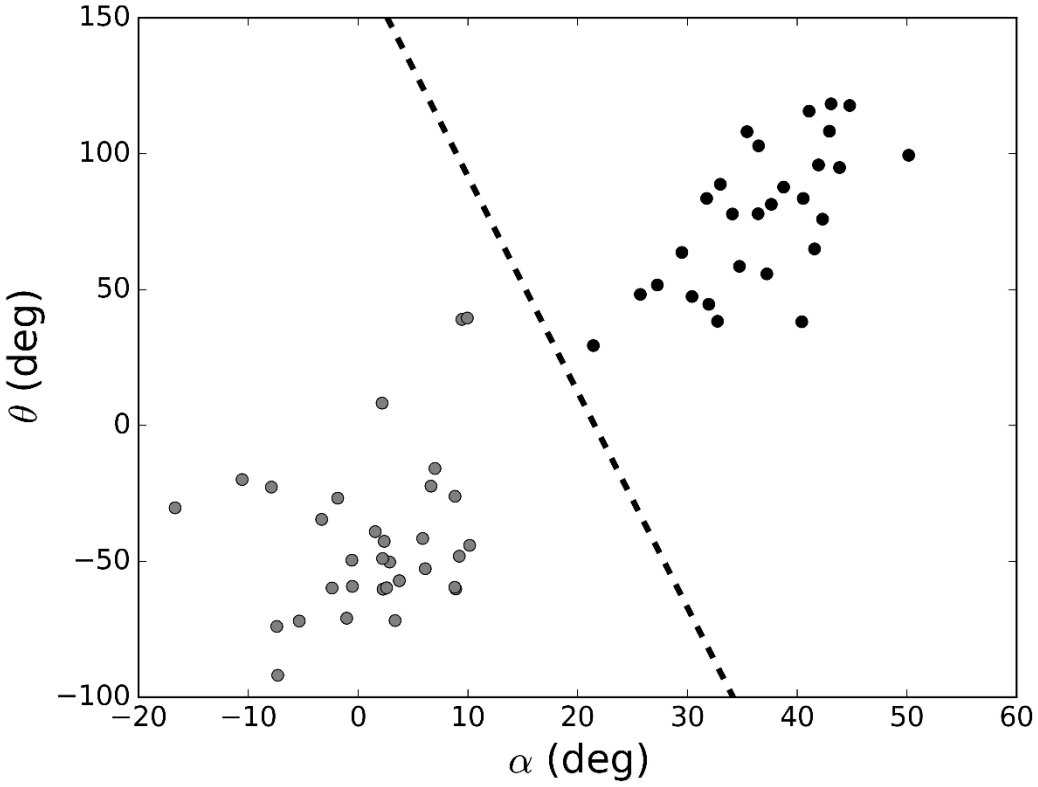
[6] Due to problems with the electronic device connection, calculations were made with 29 and 31 participants in the expansive and contractive condition, respectively.

using the procedure described by Hayes (2013) from the PROCESS macro (version 2.16), choosing model 1 and 4, respectively. Pre-ME scores were entered as covariates of post-ME scores for negative and positive ES, and BISS models. The expansive condition was coded as "1" and the contractive condition was coded as "2". Thus, a negative relationship between condition and positive ES, BISS, and appraisal of the person's own body description, and a positive relationship between condition and negative ES, and TCL meant that participants that adopted an expansive posture showed greater improvements in these measures. All regression coefficients were reported in unstandardized form as *b*-values.

Firstly, moderation analyses were carried out to examine whether the relationships between the condition and the post-ME scores of TCL, negative and positive ES, BISS and, the appraisal of the person's own body description, were moderated by BMI. Tests of significance ($p < .05$) or a confidence interval (not including zero) in the interaction "condition x BMI" answered whether the BMI moderated the effect of condition on post-ME scores. We examined the conditional effect of condition on the post-ME scores at medium (the mean), low (-1 *SD*), and high (+1 *SD*) levels of BMI with the pick-a-point approach (or analysis of the simple slopes). Secondly, as significant differences were only found in positive ES between conditions after the ME, simple mediation analyses were performed to test whether the effect of condition on post-ME scores of negative ES, BISS and appraisal of the person's own body description were mediated by the change in positive ES. Change in positive ES was calculated using pre-ME scores and post-ME scores (e.g., Change = post-score – pre-score), where positive values for change in positive ES reflected an improvement. Bias-corrected bootstrap 95% confidence intervals (CIs) based on 5,000 samples were used to assess the indirect effects. CI that did not include the zero-value indicated a significant indirect effect, meaning that the effect of

the condition on the post-ME scores was mediated by the change in positive ES. Additionally, to analyze the combined influence of the BMI and change in positive ES in the relationship between posture and post-ME scores of body image satisfaction, an exploratory moderated mediation model ("model 5") was performed. This combined the effect of condition on BISS post-ME scores indirectly through the change in positive ES, but also the direct the effect of posture on BISS post-ME scores depending on BMI.

Figure 3. Mean value of θ (the angle between shoulder blades) and α (angle between the upper arm and the trunk) during body posture manipulation.



Note. Grey circles: contractive condition; dark circles: expansive condition. The dashed line separates the two classes. deg = degrees.

3. Results

3.1. Checking differences in age, BMI, BSQ and EAT-26

Descriptive statistics are shown in Table 1. There were no significant differences between conditions on age, $t(51.94) = 1.09$, $p = .280$, *Cohen's d* = 0.27; BMI, $t(66) = 1.48$, $p = .144$, *Cohen's d* = 0.36; BSQ, $t(66) = 1.40$, $p = .165$, *Cohen's d* = 0.34; and EAT-26, $t(66) = 0.26$, $p = .796$, *Cohen's d* = 0.06.

Table 1. Descriptive statistics for age, BMI, BSQ, and EAT-26.

	Expansive condition (n = 34) *M (SD)*	**Contractive condition** (n = 34) *M (SD)*
Age (years)	22.15 (3.84)	21.32 (2.16)
BMI	23.07 (2.43)	22.13 (2.83)
BSQ	107.00 (16.95)	101.38 (16.06)
EAT-26	7.79 (5.34)	7.47 (4.95)

Note. BMI = Body Mass Index; BSQ = Body Shape Questionnaire; EAT-26 = The Eating Attitudes Test-26.

3.2. Checking the posture manipulation before the ME

Significant differences were found between conditions on the adopted posture before the ME, $t(58) = 8.60$, $p < .001$, *Cohen's d* = 2.22. Participants in the expansive condition achieved a higher expansive posture ($M = 18.43$, $SD = 19.27$) than participants in the contractive condition ($M = -20.84$, $SD = 16.05$) according to the α and θ angles.

3.3. Effects of posture on TCL, negative and positive ES, BISS, and appraisal of the person's own body descriptions

Descriptive statistics, ANCOVAs, and independent-samples t-test results for TCL, negative and positive ES, BISS, and appraisal of the person's own body descriptions are shown in Table 2. A main effect of condition for the total score of positive ES was found. Pairwise comparisons showed that participants in the expansive condition showed more positive emotions than participants in the contractive condition (p = .006). Separately, ANOVAs for self-confidence and happiness also showed a main effect of condition. Pairwise comparisons showed that participants in the expansive condition showed more self-confidence and happiness than participants in the contractive condition (p = .015 and p = .029, respectively). However, there were no main effects of condition for BISS and negative ES (insecurity, anxiety, disgust, shame, sadness, anger, and total score). In the same line, significant differences were not found between the expansive and contractive conditions on TCL and the appraisal of the person's own body comments.

Table 2. ANCOVAs and Independent-samples t-test results and values for TCL, negative and positive ES, BISS, and appraisal of the person's own body descriptions.

	Expansive condition (n = 34)		**Contractive condition** (n = 34)		**ANCOVA** [a] **/ t-Student**		
	Pre M(SD)	*Post M(SD)*	*Pre M(SD)*	*Post M(SD)*	***F / t***	***p***	***η_p^2 / Cohen's d***
TCL	-	31.50 (8.53)	-	33.41 (8.91)	$t(66) = -0.90$	.369	$d = -0.22$
Negative ES (total)	1.89 (0.69)	2.12 (1.08)	2.28 (0.87)	2.61 (1.24)	$F(1,65) = 0.34$	.551	$\eta_p^2 = .01$
Insecurity	2.79 (1.39)	2.88 (1.49)	3.56 (1.33)	3.68 (1.68)	$F(1,65) = 0.66$	.419	$\eta_p^2 = .01$
Anxiety	2.00 (1.13)	2.09 (1.31)	2.77 (1.35)	2.62 (1.78)	$F(1,65) = 0.41$	.524	$\eta_p^2 = .01$
Disgust	1.18 (0.63)	1.47 (1.21)	1.38 (0.74)	1.77 (1.02)	$F(1,65) = 0.42$	.518	$\eta_p^2 = .01$
Shame	2.27 (1.19)	2.47 (1.66)	2.32 (1.34)	2.88 (1.75)	$F(1,65) = 1.20$	.278	$\eta_p^2 = .02$
Sadness	1.79 (1.12)	2.15 (1.23)	1.94 (1.30)	2.47 (1.50)	$F(1,65) = 0.68$	.412	$\eta_p^2 = .01$
Anger	1.29 (0.52)	1.68 (1.36)	1.68 (1.27)	2.27 (1.50)	$F(1,65) = 1.30$	.258	$\eta_p^2 = .02$
Positive ES (total)	4.90 (0.89)	4.66 (1.13)	4.85 (0.92)	3.97 (1.24)	$F(1,65) = 8.10$	.006	$\eta_p^2 = .11$
Self-confidence	4.91 (1.08)	4.74 (1.36)	4.68 (1.04)	3.85 (1.52)	$F(1,65) = 6.29$	.015	$\eta_p^2 = .09$
Happiness	4.88 (1.07)	4.59 (1.16)	5.03 (1.14)	4.09 (1.29)	$F(1,65) = 4.98$	.029	$\eta_p^2 = .07$
BISS	5.02 (1.06)	4.43 (1.38)	4.97 (1.22)	4.20 (1.38)	$F(1,65) = 0.74$	.392	$\eta_p^2 = .01$
Appraisal of the person's own body descriptions	-	0.33 (1.27)	-	0.09 (0.92)	$t(65) = 0.86$	.393	$d = 0.21$

Note. [a] All ANCOVAs were adjusted for baseline scores.

TCL = Thoughts Checklist; ES = Emotions' Scale; BISS = Body Image States Scale.

3.4. Differences in the percentage of emotions felt in each condition

The crosstabs of the percentage of feelings in each condition are shown in Table 3. Results showed that the feelings differed significantly depending on the adopted posture, $\chi^2(7, N = 68) = 29.76$, $p < .001$, Cramer's V = 0.66. Participants who adopted an expansive posture experienced more "self-confidence" than participants who adopted a contractive posture (Adjusted Standarized Residuals = 3.8). Moreover, participants who adopted a contractive posture experienced more "submissiveness" (Adjusted Standarized Residuals = 3.4) and "insecurity" (Adjusted Standarized Residuals = 2.4) than participants who adopted an expansive posture.

Table 3. Crosstab of the percentage of emotions in each condition.

		Expansive condition	Contractive condition	Total
Self-confidence	Count	20	5	25
	Expected count	12.5	12.5	25.0
	%	80%	20%	100%
	ASR	3.8	-3.8	
Aplomb	Count	5	3	8
	Expected count	4.0	4.0	8.0
	%	62.5%	37.5%	100%
	ASR	0.8	-0.8	
Dignity	Count	1	0	1
	Expected count	0.5	0.5	1.0
	%	100%	0%	100%
	ASR	1.0	-1.0	
Arrogance	Count	1	0	1
	Expected count	0.5	0.5	1.0
	%	100%	0	100%
	ASR	1.0	-1.0	
Pride	Count	2	0	2
	Expected count	1.0	1.0	2.0
	%	100%	0%	100%
	ASR	1.4	-1.4	
Submissiveness	Count	0	10	10
	Expected count	5.0	5.0	10.0
	%	0%	100%	100%
	ASR	-3.4	3.4	
Sadness	Count	0	2	2
	Expected count	1.0	1.0	2.0
	%	0%	100%	100%
	ASR	-1.4	1.4	
Insecurity	Count	5	14	19
	Expected count	9.5	9.5	19.0
	%	26.3%	73.7%	100%
	ASR	-2.4	2.4	
Dominance	Count	0	0	0
	Expected count	-	-	-
	%	0%	0%	0%
	ASR	-	-	-
Total	Count	34	34	68

Note. ASR = Adjusted standardized residuals.

3.5. BMI as moderator: Does the BMI moderate the effect of posture on the TCL, negative and positive ES, BISS, and appraisal of the person's own body description?

Moderation analyses showed that the BMI moderated the effect of condition on the BISS post-ME scores, but not on the TCL, $F(1,64) = 0.11$, $p = .745$; the negative ES post-ME scores, $F(1,63) = 0.31$, $p = .583$; the positive ES post-ME scores, $F(1,63) = 0.78$, $p = .381$; or on the appraisal of the person's own body description, $F(1,63) = 0.33$, $p = .566$. In the case of the BISS, the overall model explained 63.34 % of the variance in the BISS post-ME scores, and it was significant, $F(4,63) = 46.99$, $p < .001$. The interaction between condition and BMI was significant, $F(1,63) = 5.86$, $p = .018$, meaning that BMI was a moderator of the effect of the condition on the BISS post-ME scores, accounting for 2.04% of the variance. Analysis of simple slopes showed that there was a significant negative relationship between condition and the BISS post-ME scores when the BMI was "low", $b = -0.66$, 95% CI [-1.22, -0.11], $t = -2.39$, $p = .020$. Participants in the expansive condition (compared to the contractive condition) with lower BMI achieved higher scores in body image satisfaction after the ME task.

3.6. Positive emotions as mediators: Does the posture influence negative ES, BISS and appraisal of the person's own body description through the change in positive ES?

Unstandardized regression coefficients, standard errors in parenthesis, and confidence intervals of the direct, total, and indirect effects are shown in Figure 4A, 4B and 4C. The indirect effects for all the models were significant, implying that the change in positive ES mediated the relationship between condition and the post-ME scores of negative ES, BISS, and appraisal of the person's own body. These results meant that

participants who adopted an expansive posture (compared to a contractive posture) had more positive changes in positive emotions after the ME task, leading to less negative emotions, and more positive scores in body image satisfaction and the appraisal of their own body descriptions.

3.7. Moderated mediation: How does the change in positive ES and BMI interact with the effect of posture on the BISS?

Unstandardized regression coefficients, standard errors in parentheses, and confidence interval of the indirect effects are shown in Figure 4D. In this model, the BMI did not moderate the direct effect of posture on BISS post-ME (independent of the influence of posture on BISS post-ME scores through change in positive ES), as the interaction between condition and BMI was not significant, b = 0.09, SE = 0.07, t = 1.33, p = .190, 95% CI [-0.05, 0.23], and any conditional direct effect was significant at any value of the moderator: “low BMI”, b = -0.20, SE = 0.25, t = -0.82, p = .417, 95% CI [-0.69, 0.29]; “medium BMI”, b = 0.05, SE = 0.19, t = 0.25, p = .807, 95% CI [-0.33, 0.42], “high BMI”, b = 0.29, SE = 0.28, t = 1.04, p = .301, 95% CI [-0.27, 0.85]. However, the indirect effect remained significant, b = -0.33, SE = 0.14, 95% CI [-0.66, -0.10]. Hence, the posture exerted its effect on body image satisfaction after the ME indirectly through the change in positive emotions, but not directly when the BMI was introduced as moderator.

Figure 4. Simple mediation analyses (Figs 4A, 4B and 4C) and moderated mediation analysis (Fig 4D).

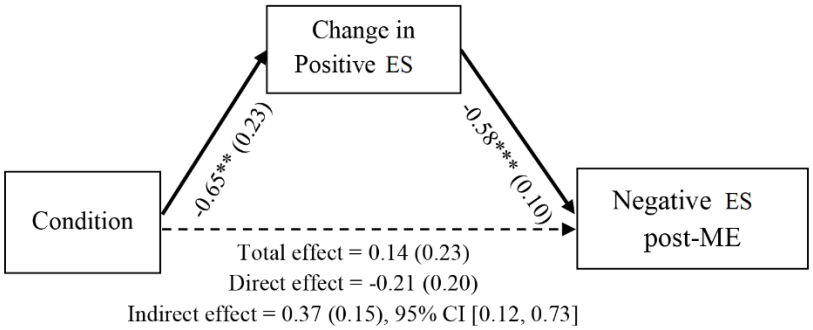


Fig 4A

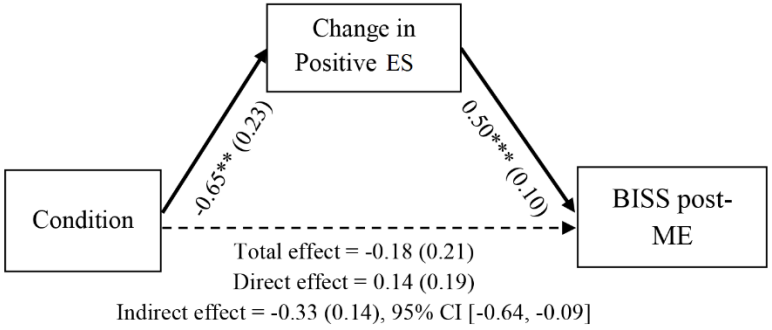


Fig 4B

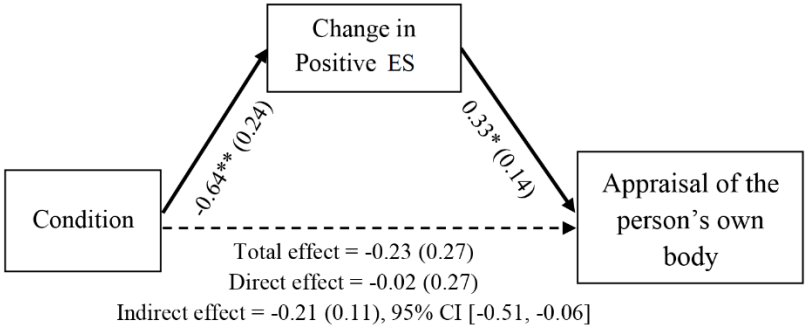


Fig 4C

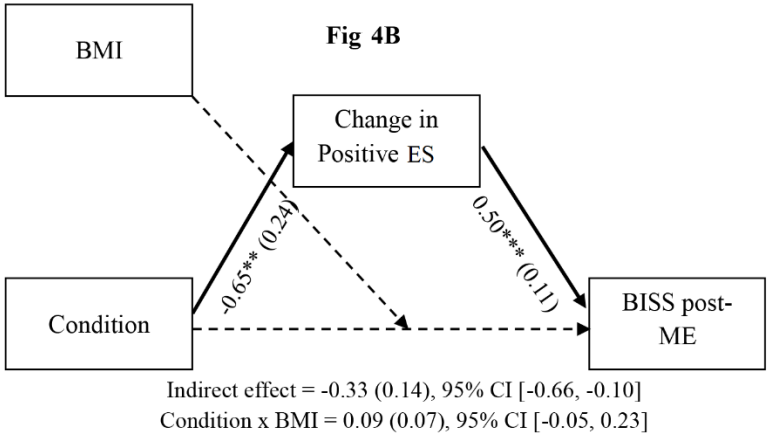


Fig 4D

Note. All coefficients represent unstandardized regression coefficients (standard errors in parenthesis). Pre-ME scores of negative ES and BISS are entered as covariates in the negative ES and BISS models. * $p < .05$; ** $p < .01$; *** $p < .001$. ME = Mirror Exposure; BISS = Body Image States Scale; ES = Emotions' Scale. BMI = Body Mass Index.

4. Discussion

The main objective of this study was to analyze the effect of adopting an expansive (vs. a contractive) posture for 2 minutes before an ME task on body- and eating-related negative thoughts during the ME, as well as on positive and negative emotions, body image satisfaction, and appraisal of the person's own body description after the ME. Moreover, the secondary objectives were to explore the differences in the percentage of emotions felt by the women while they were holding each posture, as well as to analyze the possible moderator and mediator variables of the effect of the posture on the body-related emotions and cognitions.

Firstly, the successful manipulation of the posture was checked. The electronic device showed that there were significant differences in the expansiveness of the body between both conditions. Regarding the effects of posture on the body-related emotions and cognitions after the ME, results showed that only the level of positive emotions after the ME changed, as women who adopted an expansive posture showed more positive emotions (a combination of happiness and self-confidence). This is in line with other studies that have shown that expansive or upright postures generate changes in positive emotions (e.g., Nair et al., 2015; Wilkes, Kydd, Sagar, & Broadbent, 2017). Moreover, it has corroborated the conclusion drawn by Jonas et al. (2017) about the necessity of analyzing the effect of expansive posture on other variables beyond the "feelings of power", which has been one of the most studied variables related to the effects of this posture up to now. Nevertheless, significant differences were not found between condition on body- and eating-related negative thoughts during the ME, nor negative emotions, body image satisfaction, and appraisal of the person's own body description after the ME. Hence, the first hypothesis was partially supported. In the same line, it was found that a greater percentage of women experienced self-confidence in the expansive

condition, while it was found that a greater percentage of women experienced submissiveness and insecurity in the contractive condition. Hence, the second hypothesis was supported.

Regarding the third hypothesis, it was partially supported because the BMI only moderated the relationship between the effect of posture on body image satisfaction, but not the rest of body-related emotions and cognitions. Although the moderation did not emerge in the rest of the outcome variables, it is in line with the meta-analysis of Stice (2002) who found an association between BMI and body dissatisfaction. Thus, women with lower BMI achieved a better body image satisfaction after the ME when they had adopted an expansive posture.

In addition, the exploratory mediation analyses showed that the change in positive emotions after the ME acted as a mechanism of change in the effect of adopting an expansive (vs. contractive) posture on negative emotions, body image satisfaction and appraisal of the person's own body. It suggests that a preparatory expansive posture before the ME acts as an inducer of positive emotions, which helps to re-evaluate the body in a more positive way. This result contradicts the inconsistent effects of the "power poses" (or expansive postures) found in recent replications of the study by Carney et al. (2010) (e.g., Garrisson, Tang, & Schmeichel, 2016; Ranehill et al., 2015) or the results of an analysis of different studies made by Simmons and Simonsohn (2017) that concluded that there is a lack of empirical support for the effects of "power poses". As De Zabala, Lantos, and Bowden (2017) hypothesized, the inconsistent effects of "power poses" may be related to the lack of manipulation of the lift of the spine and the expansion of the chest. In fact, they compared open and closed front body yoga postures (e.g., emphasizing the lift of the spine and the expansion of the chest) and the expansive and contractive postures used in other studies such as Carney et al. (2010), showing that yoga postures

(as compared to "power poses") improved self-esteem through increasing the subjective sense of energy and empowerment.

Although yoga postures were not adopted in this study, some manipulations that were not considered in other expansive-contractive postures studies (e.g., Carney et al., 2010; Cuddy et al., 2015; Garrisson et al., 2016; Ranehill et al., 2015) were emphasized, such as the position of the back and the chest. Thus, in this case, the position of the back and the chest as well as the expansiveness of the body seem to improve the body-related emotions and cognitions after the ME driven by the increase in happiness and self-confidence. Because of that, it is important to determine what adopted posture is effective to change a specific psychological variable, as other postures may have no effects or contrary effects in the cognitive and emotional response in the ME because they are driven by other mechanisms (e.g., dominance in the case of expansive postures without manipulating the back or chest).

Thus, the role of positive emotions as a mechanism of change in the effect of posture on body-related emotions and cognitions seems highly relevant. The exploratory moderated mediation analysis showed that when the effect of the BMI and change in positive emotions were introduced in the same model, the BMI was no longer relevant in explaining the changes in body image satisfaction, as the conditional direct effect of the posture on body image satisfaction depending on BMI disappeared. Results suggest that when an expansive posture is adopted, it generates such a strong change in positive emotions that the BMI of the women does not have any influence on the increase of the body image satisfaction after the ME.

The limitations of the current study should be noted. First, the study has been done with a non-clinical sample, so the results are not completely generalizable to other populations, and it is especially relevant whether this response is replicable in ED

samples. Although several ME-related studies have recruited non-clinical samples to analyze its effects (e.g., Luethcke et al., 2011), the study by Trentowska, Svaldi, Blechert, and Tuschen-Caffier (2017) supports the view that non-clinical samples react to ME at a much lower level and with different emotional changes than patients with ED (e.g., bulimia nervosa). Second, a control condition was not used because it was intended to analyze the differences between an expansive and a contractive posture. However, a third condition, with a natural posture without manipulating the body could help to resolve whether a preparatory expansive posture has superior positive effects in the cognitive and emotional response in the ME over a preparatory natural posture. Third, although the participants should look at different parts of their body, it was not possible to verify whether they were looking at the specific part or if they avoided some parts. Forth, physiological measures (e.g., skin conductance, heart rate) were not used. It would have been interesting to have these measures in order to analyze the role of posture in these responses. Servián-Franco, Moreno-Domínguez, and del Paso (2015) found that women with high body dissatisfaction showed a reduced physiological response compared to women with low body dissatisfaction. The authors suggested that this low response could be related to a passive (vs. an active) coping style that could interfere in the efficacy of the ME. Because of this, future studies should analyze the physiological effects of the posture in the ME, and explore the possible relation with an active or passive style of coping during the exposure. In addition, it would have been interesting to assess the posturographic destabilization of the women's body to analyze whether a preparatory posture generates differences between conditions on postural destabilization.

Moreover, more research is needed in order to analyze whether the posture improves the outcomes in the ME treatment of patients with ED. According to the approaches that try to explain the mechanisms underlying the exposure therapy, such as

the habituation-based models (e.g., "emotional processing model"; Foa & Kozak, 1986), there is a negative response that makes the exposure work. Trentowska et al. (2013) concluded that the process of change in the ME related to the improvement in body image in patients with ED is comparable to fear habituation processes. In the same line, Trentowska et al. (2017) found a cognitive and emotional (although not physiological) habituation within and between ME sessions in patients with ED. Nevertheless, Díaz-Ferrer et al. (2017) found that the subjective discomfort was maintained in the first session without evidence of within-session habituation process, making it comparable to the inhibitory learning model of extinction (Craske et al., 2008; Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014). Hence, it is important to test whether the adoption of an expansive posture has negative consequences for the therapy, impeding the necessary negative response claimed by some models (e.g., Foa & Kozak, 1986), or, in contrast, it has positive consequences for the therapy through the increase in positive emotions, making within-session habituation easier (e.g., increasing the view of one's ability to actively cope with the exposure), making between-session habituation easier (e.g., increasing the adherence to several sessions of exposure therapy), or making easier the development of new non-threating associations within sessions, competing with the original negative response.

Hence, psychological interventions should explore the convenience of holding an expansive posture before the ME in women with body dissatisfaction. In fact, some authors have highlighted the necessity to determine which body manipulations could be beneficial to modify the cognitions and emotions in therapy (Folk et al., 2016). These authors proposed the embodied cognition area as a field that has clear clinical applications as a "wise intervention", a kind of intervention outlined by Walton (2014).

In conclusion, this study shows the role of preparatory postures on changing the body-related emotions and cognitions after being exposed to the person's own body in an ME task in women with high body dissatisfaction. The main finding of this study is that more positive emotions are achieved when an expansive (vs. contractive) posture is adopted for 2 minutes before an ME task. Moreover, the increase in positive emotions constitutes the mechanism of change of the effect of adopting an expansive posture on reducing negative emotions, and increasing body image satisfaction and the appraisal of the person's own body after the ME. In line with embodied cognition and emotion theories, the results of this study suggest that the adoption of an expansive posture seems to be a promising therapeutic strategy and that it should continue to be explored due to its positives effects on the cognitive and emotional response in the ME. However, more research is needed in order to establish how, when, or for whom the adoption of an expansive posture is effective in the exposure to the person's own body.

5. References

Allen, J., Gervais, S. J., & Smith, J. L. (2013). Sit big to eat big: The interaction of body posture and body concern on restrained eating. *Psychology of Women Quarterly, 37*(3), 325–336. doi: 10.1177/0361684313476477

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, *59*, 617–645. doi:10.1146/annurev.psych.59.103006.093639

Briñol, P., Petty, R. E., & Wagner, B. (2009). Body posture effects on self-evaluation: A self-validation approach. *European Journal of Social Psychology*, *39*(6), 1053–1064.

Carney, D. R., Cuddy, A. J., & Yap, A. J. (2010). Power posing brief nonverbal displays affect neuroendocrine levels and risk tolerance. *Psychological Science, 21*(10), 1363–1368. doi:10.1177/0956797610383437

Carney, D. R., Cuddy, A. J., & Yap, A. J. (2015). Review and summary of research on the embodied effects of expansive (vs. contractive) nonverbal displays. *Psychological Science*, *26*(5), 657–663. doi:10.1177/0956797614566855

Cash, T.F., Fleming, E.C., Alindogan, J., Steadman, L., & Whitehead, A. (2002). Beyond body image as a trait: The development and validation of the Body Image States Scale. *Eating Disorders: The Journal of Treatment & Prevention, 10,* 103–113. doi: 10.1080/10640260290081678

Cooper, M. J., & Fairburn, C. G. (1992). Thoughts about eating, weight and shape in anorexia nervosa and bulimia nervosa. *Behaviour Research and Therapy*, *30*(5), 501–511. doi: 10.1016/0005-7967(92)90034-E

Cooper, P.J. & Taylor, M.J. (1988). Body image disturbance in bulimia nervosa. *British Journal of Psychiatry, 153*(2), 32–36.

Cooper, P.J., Taylor, M.J., Cooper, Z. & Fairburn, C.G. (1987). The development and validation of the Body Shape Questionnaire. *International Journal of Eating Disorders,* 6, 485–494. doi: 10.1002/1098-108X(198707)6:4<485::AID-EAT2260060405>3.0.CO;2-O

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, *46*(1), 5–27. doi: 10.1016/j.brat.2007.10.003

Craske, M. G., Treanor, M., Conway, C. C., Zbozinek, T., & Vervliet, B. (2014). Maximizing exposure therapy: An inhibitory learning approach. *Behaviour Research and Therapy*, *58*, 10–23. doi: 10.1016/j.brat.2014.04.006

Cuddy, A. J., Wilmuth, C. A., Yap, A. J., & Carney, D. R. (2015). Preparatory power posing affects nonverbal presence and job interview performance. *Journal of Applied Psychology*, *100*(4), 1286. doi:10.1037/a0038543

De Zavala, A. G., Lantos, D., & Bowden, D. (2017). Yoga poses increase subjective energy and state self-esteem in comparison to 'power poses'. *Frontiers in Psychology*, *8*. doi: 10.3389/fpsyg.2017.00752

Delinsky, S. S., & Wilson, G. T. (2006). Mirror exposure for the treatment of body image disturbance. *International Journal of Eating Disorders*, *39*(2), 108–116. doi:10.1002/eat.20207

Díaz-Ferrer, S., Rodríguez-Ruiz, S., Ortega-Roldán, B., Mata-Martín, S., & Fernández-Santaella, M. C. (2017). Psychophysiological changes during pure vs guided mirror exposure therapies in women with high body dissatisfaction: What are they learning about their bodies? *European Eating Disorders Review*, doi: 10.1002/erv.2546

Díaz-Ferrer, S., Rodríguez-Ruiz, S., Ortega-Roldán, B., Moreno-Domínguez, S., & Fernández-Santaella, M. C. (2015). Testing the efficacy of pure versus guided mirror exposure in women with bulimia nervosa: A combination of neuroendocrine and psychological indices. *Journal of Behavior Therapy and Experimental Psychiatry, 48*, 1–8. doi: 10.1016/j.jbtep.2015.01.003

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191.

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin*, *99*(1), 20. doi: 10.1037/0033-2909.99.1.20

Folk, J. B., Disabato, D. J., Goodman, F. R., Carter, S. P., DiMauro, J. C., & Riskind, J. H. (2016). Wise additions bridge the gap between social psychology and clinical practice: Cognitive-behavioral therapy as an exemplar. *Journal of Psychotherapy Integration.* Advance online publication. doi: 10.1037/int0000038

Forghieri, M., Monzani, D., Mackinnon, A., Ferrari, S., Gherpelli, C., & Galeazzi, G. M. (2016). Posturographic destabilization in eating disorders in female patients exposed to body image related phobic stimuli. *Neuroscience Letters*, *629*, 155–159. doi: 10.1016/j.neulet.2016.07.002

Galeazzi, G. M., Monzani, D., Gherpelli, C., Covezzi, R., & Guaraldi, G. P. (2006). Posturographic stabilisation of healthy subjects exposed to full-length mirror image is inversely related to body-image preoccupations. *Neuroscience Letters*, *410*(1), 71–75. doi: 10.1016/j.neulet.2006.09.077

Gandarillas, A., Zorrilla, B., Sepúlveda, A.R., & Muñoz, R. (2003). Trastornos del comportamiento alimentarios: Prevalencia de casos clínicos en mujeres adolescentes de la Comunidad de Madrid [Eating behavior disorders: Prevalence of clinical cases in adolescent women in the Community of Madrid]. *Documentos Técnicos de Salud Pública, Instituto de Salud Pública, 85.*

Garner, D. M., Olmsted, M. P., Bohr, Y., & Garfinkel, P. E. (1982). The eating attitudes test: Psychometric features and clinical correlates. *Psychological Medicine*, *12*(4), 871–878. doi: 10.1017/S0033291700049163

Garrison, K. E., Tang, D., & Schmeichel, B. J. (2016). Embodying power: A preregistered replication and extension of the power pose effect. *Social Psychological and Personality Science*, *7*(7), 623–630. doi: 10.1177/1948550616652209

Gronau, Q. F., van Erp, S., Heck, D. W., Cesario, J., Jonas, K., & Wagenmakers, E. J. (2017). A Bayesian Model-Averaged Meta-Analysis of the Power Pose Effect with

Informed and Default Priors: The Case of Felt Power. *Comprehensive Results in Social Psychology, 2*(1), 123-138. doi: 10.1080/23743603.2017.1326760

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.

Hildebrandt, T., Loeb, K., Troupe, S., & Delinsky, S. (2012). Adjunctive mirror exposure for eating disorders: A randomized controlled pilot study. *Behaviour Research and Therapy, 50*(12), 797–804. doi: 10.1016/j.brat.2012.09.004

Jansen, A., Voorwinde, V., Hoebink, Y., Rekkers, M., Martijn, C., & Mulkens, S. (2016). Mirror exposure to increase body satisfaction: Should we guide the focus of attention towards positively or negatively evaluated body parts? *Journal of Behavior Therapy and Experimental Psychiatry, 50*, 90–96. doi: 10.1016/j.jbtep.2015.06.002

Jonas, K. J., Cesario, J., Alger, M., Bailey, A. H., Bombari, D., Carney, D., ... & Jackson, B. (2017). Power poses–where do we stand? *Comprehensive Results in Social Psychology, 2*(1), 139–141. doi: 10.1080/23743603.2017.1342447

Key, A., George, C. L., Beattie, D., Stammers, K., Lacey, H., & Waller, G. (2002). Body image treatment within an inpatient program for anorexia nervosa: The role of mirror exposure in the desensitization process. *International Journal of Eating Disorders, 31*(2), 185–190. doi:10.1002/eat.10027

Kolnes, L. J. (2012). Embodying the body in anorexia nervosa–a physiotherapeutic approach. *Journal of Bodywork and Movement Therapies, 16*(3), 281–288. doi: 10.1016/j.jbmt.2011.12.005

Körner, A., Topolinski, S., & Strack, F. (2015). Routes to embodiment. *Frontiers in Psychology, 6*. doi: 10.3389/fpsyg.2015.00940

Koskina, A., Campbell, I. C., & Schmidt, U. (2013). Exposure therapy in eating disorders revisited. *Neuroscience & Biobehavioral Reviews, 37*(2), 193–208. doi: 10.1016/j.neubiorev.2012.11.010

Kozak, M. N., Roberts, T. A., & Patterson, K. E. (2014). She stoops to conquer? How posture interacts with self-objectification and status to impact women's affect and performance. *Psychology of Women Quarterly, 38*(3), 414–424. doi: 10.1177/0361684313517865

Luethcke, C. A., McDaniel, L., & Becker, C. B. (2011). A comparison of mindfulness, nonjudgmental, and cognitive dissonance-based approaches to mirror exposure. *Body Image, 8*(3), 251–258. doi:10.1016/j.bodyim.2011.03.006

Michalak, J., Mischnat, J., & Teismann, T. (2014). Sitting posture makes a difference—embodiment effects on depressive memory bias. *Clinical Psychology & Psychotherapy*, *21*(6), 519–524. doi: 10.1002/cpp.1890

Nair, S., Sagar, M., Sollers III, J., Consedine, N., & Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology*, *34*(6), 632. doi:10.1037/hea0000146

Niedenthal, P. M. (2007). Embodying emotion. *Science*, *316*(5827), 1002–1005. doi:10.1126/science.1136930

Ortega-Roldán, B., Rodríguez-Ruiz, S., Díaz-Ferrer, S., Fernández-Santaella, M. C., & Vila, J. (2014). Feeling bad posing as a model: An objective manner of study upward own-body comparisons in body-dissatisfied women. *European Eating Disorders Review*, *22*(6), 470–478. doi:10.1371/journal.pone.0102595

Ortega-Roldán, B., Rodríguez-Ruiz, S., Perakakis, P., Fernández-Santaella, M. C., & Vila, J. (2014). The emotional and attentional impact of exposure to one's own body in bulimia nervosa: A physiological view. *PloS One*, *9*(7), e102595. doi: 10.1371/journal.pone.0102595

Piedmont, R. L. (2014). Inter-item correlations. In Michalos, A.C (Ed.), *Encyclopedia of quality of life and well-being research.* Netherlands: Springer.

Raich, R.Mª, Mora, M., Soler, A., Ávila, C., Clos, I., & Zapater, I. (1996). Adaptación de un instrumento de evaluación de la insatisfacción corporal [Adaptation of an instrument for assessing body dissatisfaction]. *Clínica y Salud*, *7*(1), 51–66.

Ranehill, E., Dreber, A., Johannesson, M., Leiberg, S., Sul, S., & Weber, R. A. (2015). Assessing the robustness of power posing: No effect on hormones and risk tolerance in a large sample of men and women. *Psychological Science*, *26*(5), 653–656. doi: 10.1177/0956797614553946

Saghaei, M. (2004). Random allocation software for parallel group randomized trials. *BMC Medical Research Methodology*, *4*(1), 26. doi: 10.1186/1471-2288-4-26

Servián-Franco, F., Moreno-Domínguez, S., & del Paso, G. A. R. (2015). Body dissatisfaction and mirror exposure: Evidence for a dissociation between self-report and physiological responses in highly body-dissatisfied women. *PloS One*, *10*(4), e0122737. doi: 10.1371/journal.pone.0122737

Simmons, J. P., & Simonsohn, U. (2017). Power posing: P-curving the evidence. *Psychological Science*, *28*(5), 687–693. doi: 10.1177/0956797616658563

Stice, E. (2002). Risk and maintenance factors for eating pathology: a meta-analytic review. *Psychological Bulletin*, *128*(5), 825. doi:10.1037/0033-2909.128.5.825

Trentowska, M., Bender, C., & Tuschen-Caffier, B. (2013). Mirror exposure in women with bulimic symptoms: How do thoughts and emotions change in body image treatment? *Behaviour Research and Therapy*, *51*(1), 1–6. doi: 10.1016/j.brat.2012.03.012

Trentowska, M., Svaldi, J., Blechert, J., & Tuschen-Caffier, B. (2017). Does habituation really happen? Investigation of psycho-biological responses to body exposure in bulimia nervosa. *Behaviour Research and Therapy*, *90*, 111–122. doi: 10.1016/j.brat.2016.12.006

Trentowska, M., Svaldi, J., & Tuschen-Caffier, B. (2014). Efficacy of body exposure as treatment component for patients with eating disorders. *Journal of Behavior Therapy and Experimental Psychiatry*, *45*(1), 178–185. doi: 10.1016/j.jbtep.2013.09.010

Tuschen-Caffier, B., Vögele, C., Bracht, S., & Hilbert, A. (2003). Psychological responses to body shape exposure in patients with bulimia nervosa. *Behaviour Research and Therapy*, *41*(5), 573–586. doi:10.1016/S0005-7967(02)00030-X

Vocks, S., Legenbauer, T., Wächter, A., Wucherer, M., & Kosfelder, J. (2007). What happens in the course of body exposure?: Emotional, cognitive, and physiological reactions to mirror confrontation in eating disorders. *Journal of Psychosomatic Research*, *62*(2), 231–239. doi: 10.1016/j.jpsychores.2006.08.007

Walton, G. M. (2014). The new science of wise psychological interventions. *Current Directions in Psychological Science*, *23*(1), 73–82. doi: 10.1177/0963721413512856

Wilkes, C., Kydd, R., Sagar, M., & Broadbent, E. (2017). Upright posture improves affect and fatigue in people with depressive symptoms. *Journal of Behavior Therapy and Experimental Psychiatry*, *54*, 143–149. doi: 10.1016/j.jbtep.2016.07.015

Winkielman, P., Niedenthal, P., Wielgosz, J., Eelen, J., & Kavanagh, L.C. (2015). Embodiment of cognition and emotion. In M. Mikulincer, P.R. Shaver, E. Borgida, J.A. Bargh (Eds.), *APA handbooks in psychology. APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 151-175). Washington, DC, US: American Psychological Association.

CHAPTER 4. Study 3

Effect of an upright (vs. stooped) posture on interpretation bias, imagery, and emotions

---

This chapter is currently under review as: Miragall, M., Borrego, A., Cebolla, A., Etchemendy, E., Navarro-Siurana, J., Llorens, R., Blackwell, S., & Baños, R.M. Effect of an upright (vs. stooped) posture on interpretation bias, imagery, and emotions

Abstract

Adopting an upright (vs. stooped) posture has been related to positive effects on emotional and cognitive processes. However, there is no evidence concerning the effect of posture on two key processes associated with the maintenance of depression: interpretation bias and vividness of emotional imagery. The aims of this study were to investigate the effect of adopting an upright (vs. stooped) posture on interpretation bias and vividness of positive and negative mental imagery, as well as to explore the interplay between these processes and depression-related emotions. The sample consisted of 54 participants (M_{age} = 22.00, 64.8% women), who were randomly assigned to the upright or stooped condition. Participants answered self-report measures while they were adopting a specific posture. Posture was monitored through inertial technology. Main results were that: (1) upright (vs. stooped) posture led to more positive interpretations of ambiguous information and increased positive emotions; (2) time in upright position was associated with change in interpretation bias and vividness of positive mental imagery; and (3) level of depressive symptomatology moderated the effect of posture on the change in interpretation bias. This study indicates that body posture interacts with mechanisms involved in the maintenance of depression, as well as with depression-related emotions.

Keywords: interpretation bias; mental imagery; upright posture; stooped posture; depression

1. Introduction

Major depression is a mental disorder comprised of emotional, cognitive, and behavioral symptoms, including depressed mood or a loss of interest or pleasure, and a set of further specific symptoms (e.g., change in activity and/or sleep, concentration, fatigue) (American Psychiatric Association, 2013). The World Health Organization (WHO)[7] estimated that more than 300 million individuals of all ages −equivalent to 4.4% of the world's population− were depressed in 2015, constituting the largest contributor to global disability and to deaths by suicide (WHO, 2017).

Evidence has suggested an important role for cognitive biases, such as in attention (e.g., attending to emotionally congruent cues), memory (e.g., recalling more unpleasant memories), and interpretation (e.g., interpreting ambiguous events in a more negative manner), in the context of depression (Evaraert, Koster, & Derakshan, 2012; Gotlib & Joorman, 2010; Mathews & Macleod, 2005). In fact, several cognitive models have implicated these cognitive biases as mechanisms involved in the etiology and maintenance of depression (e.g., Clark, Beck, & Alford, 1999; Ingram, 1984; Joorman, Yoon, & Zetsche, 2007; Williams, Watts, MacLeod, & Mathews, 1988; 1997). More specifically, the interplay between attentional bias to negative information and negative interpretation bias has been found to account for significant variance in the severity of depressive symptoms and diagnostic status (e.g., currently or never depressed), and, interpretation bias in particular seems to be a core component in the interplay among depression-related cognitive biases (Sanchez, Duque, Romero, & Vázquez, 2017).

[7] *Abbreviations:* WHO = World Health Organization; ICS: Interacting Cognitive Subsystems; BDI-II = Beck Depression Inventory II; AST-D-II = The Ambiguous Scenarios Test for depression-related interpretation bias; PIT = Prospective Imagery Task; POMS = The Profile of Mood States; ES = Emotions' Scale.

It has also been suggested that individuals with depression experience an excess of intrusive involuntary negative mental imagery, a lack of positive imagery, and a difficulty in generating specific images of the past or future (Holmes, Blackwell, Burnett-Heyes, Renner, & Raes, 2016). Indeed, Holmes, Lang, and Deeprose (2009) have pointed out that disturbances in mental imagery (negative intrusive imagery and lack of positive imagery) may contribute to maintain and exacerbate depression, acting independently or interacting with the negative interpretation bias.

While the above accounts concern the influence of cognitive processes on emotion, embodied cognition and emotion theories have highlighted the role of sensory or motor bodily states in shaping cognitive and emotional processes (Barsalou, 2008; Niedenthal, 2007; Winkielman, Niedenthal, Wielgosz, Eelen, & Kavanagh, 2015). Specifically, the adoption of upright (vs. stooped) postures has been related to changes in memory processes, a bias that occurs in people with depression. In an experiment conducted by Michalak, Mischnat, and Teismann (2014), participants with major depression were asked to create a visual scene for positive (e.g., enjoyable) and negative (e.g., exhaustion) words by imagining themselves in connection with the presented word (e.g., a scene in which they felt exhaustion) while they were maintaining an upright or stooped posture. After a distraction task, participants seated in a stooped posture recalled more negative words, while participants seated in an upright posture showed a balanced recall of positive and negative words. Other studies with non-clinical samples have shown similar results. For instance, Wilson and Peper (2004) assessed whether it was easier to generate positive and negative past events in an upright or stooped body posture, finding that positive past events were easier to recall in the upright posture. Tsai, Peper, and Lin (2016) recorded the electroencephalogram patterns of individuals during the recall of positive and negative events while they were maintaining an upright or stooped posture,

and authors reported that evoking positive events required more effort or arousal (e.g., increase in high-frequency oscillatory activities) while in a stooped, compared to an upright, posture.

Moreover, the adopted posture seems to have different effects on the emotional symptoms that may arise in depression. Wilkes, Kydd, Sagar, and Broadbent (2017) found that upright (vs. the usual) posture may increase positive affect, reduce fatigue, and decrease self-focus in a speech task in people with mild to moderate depression. In the same line, Veenstra, Schneider, and Koole (2016) found that posture can play an important role in recovery from negative mood. Participants who adopted a stooped (vs. upright) posture recovered less from their negative mood after a negative mood induction. Furthermore, this finding was maintained regardless of whether participants performed cognitive reappraisal or not.

The role of the body in the maintenance of depression has been highlighted in the Interacting Cognitive Subsystems (ICS) approach (Barnard & Teasdale, 1991; Teasdale & Barnard, 1993). This is a theoretical comprehensive model of the organization and function of the resources underlying individuals' cognition, which proposes that there are several cognitive subsystems specialized in handling different information. One of them is the "implicational subsystem", which is directly linked to emotion, and encodes schematic models that processes more implicit, generic, and holistic levels of meanings (e.g., global negative view of self, hopeless view of the future). It integrates information from two other subsystems: the "propositional subsystem" (which encodes specific, explicit, factual, or conceptual meanings; e.g., whether one has recently failed) and the "body state subsystem" (which encodes sensory inputs from taste, smell, touch, pain, and proprioception; e.g., whether the posture was upright or stooped, or the expression was frowning or smiling). According to this approach, depressed states arise when depressed-

related schematic models are produced from negative propositional meanings and negative body states, and are maintained because there is an interlocked negative feedback loop across the different subsystems.

Despite the empirical evidence and theoretical approaches that highlight the effects of some bodily states on emotional and cognitive processes, so far no studies have analyzed the effect of posture on two key processes associated with the maintenance of depressed mood according to Holmes et al. (2009): interpretation bias and abnormalities in imagery. Hence, the main objective of this study was to analyze the effect of adopting an upright (vs. stooped) posture on the processing of ambiguous information and the ability to generate vivid positive and negative mental imagery in people across a range of levels of depression severity, from absent to moderate symptoms of depression. To do so, the thoracic spine flexion was recorded using inertial technology to ensure that participants in each condition held the appropriate posture.

The secondary aims of this study were to investigate the effects of posture on several depression-related emotions (secondary outcomes), and to explore the interactions between posture, interpretation bias, imagery, and emotions. Specifically, the second objective of this study was to analyze the effect of adopting an upright (vs. stooped) posture on emotional responses (e.g., sadness, happiness). The third objective was to explore the relationship between the percentage of time spent in an upright posture (defined as having an extended cervical spine position) and the change in the primary outcomes (interpretation bias and imagery) and the secondary outcomes (emotions). Finally, the fourth objective was to analyze depressive symptomatology as a possible moderator in the effect of posture on interpretation bias and mental imagery.

According to the effects of posture on memory bias (e.g., Mischalak et al., 2014) and emotions (e.g., Wilkes et al., 2017), it was expected that the upright (vs. stooped)

posture would enhance the accessibility of "positive" cognitions and emotions. This assumption is in line with the embodied cognition mechanism proposed by Körner, Topolinski, and Strack (2015), which states that bodily states can directly modify the state of mind, the feelings, or the information processing of an individual. Hence, the first hypothesis was that adopting an upright (vs. stooped) posture would lead to individuals interpreting the ambiguous scenarios more positively, imagining the positive future scenarios more vividly, and imagining the negative future scenarios less vividly. The second hypothesis was that participants who adopted an upright (vs. stooped) posture would experience more positive emotions (e.g., vigor, happiness) and less negative emotions (e.g., fatigue, sadness).

The following third and fourth hypotheses were derived from the ICS approach (Barnard & Teasdale, 1991; Teasdale & Barnard, 1993). Thus, the third hypothesis was that the percentage of time that participants spent in an upright posture (measured by inertial technology), independently of the experimental condition, would be correlated with positive changes both in primary outcomes (interpretation bias and imagery) and secondary outcomes (emotions). That is, the more time the "body state subsystem" spent receiving inputs from the posture (e.g., stooped posture), the more effects there will be on the "implicational subsystem" (e.g., a more negative global view of themselves), leading to increases the interpretation bias, imagery, and emotions related to depressive states. The fourth hypothesis was that the level of depressive symptomatology would moderate the effect of upright (vs. stooped) posture on interpretation bias and mental imagery (e.g., people with higher depressive symptomatology would experience a more negative change in interpretation bias if adopting a stooped posture). That is, if individuals who already have depressed-related schematic models receive negative inputs from their

posture, they will experience a negative feedback loop between subsystems, increasing the negative interpretation bias and imagery related to depressive states.

2. Method

2.1. Participants

A total of 26 participants per condition were planned to be included in the sample, in order to detect a medium-to-large effect size for the primary outcomes (*Cohen's d* = 0.70), and taking into account an alpha error of .05, and statistical power of .80. This effect size was chosen with reference to related studies with similar outcomes, such as memory bias, negative affect, or fatigue (e.g., Mischalak et al., 2014; Nair, Sagar, Sollers, Consedine, & Broadbent, 2015; Wilkes et al., 2017). Four more participants were recruited to preserve statistical power in case of exclusions. The sample size was determined using *G*Power 3* program (Faul, Erdfelder, Lang, & Buchner, 2007).

The eligibility criteria for the present study included: 1) to have a score between 0 and 27 in the Beck Depression Inventory II (BDI-II); and 2) to be a native Spanish speaker. The exclusion criteria were: 1) to be currently under psychological treatment; and 2) risk of suicidality (> 1 on the suicidality item of the BDI-II).

The sample was recruited in the Psychology degree classrooms at the University of Valencia, where researchers invited the students to participate in a study aiming to explore the processes involved in well-being. Students completed the screening questionnaires (sociodemographic information and the BDI-II), and those who met the inclusion and exclusion criteria were invited to participate by phone. The screening questionnaires were completed by 259 individuals, but only 158 met the criteria to participate. However, 59 participants did not respond to the phone call, 36 declined to participate in the experiment

for different reasons (e.g., incompatibility of schedule, they were not interested in), and 7 did not come to the laboratory appointment.

The total sample was composed of 54 students with non/minimal, mild, or moderate depressive symptomatology[8] (total score in BDI-II ≤ 28). The mean age of the sample was 22.00 (*SD* = 2.84, range: 18 to 32), 64.8% were women, and the mean score on the BDI-II was 9.39 (*SD* = 7.60, range: 0 to 26). Regarding exclusions, 2 participants were excluded due to knowing the specific objective of the study (e.g., the link between posture, interpretation bias, and imagination) or scoring > 28 on the BDI-II on the day of the experiment.

All participants signed the informed consent documents before filling the screening questionnaires and starting the experiment, in accordance with the Declaration of Helsinki. The Ethics Committee at University of Valencia approved the study.

2.2. Measures and materials

2.2.1. Sociodemographic information. An *ad-hoc* questionnaire was made to collect information regarding: age, sex, work status, education, and previous depressive episodes.

2.2.2. Depressive symptomatology: The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a self-report questionnaire consisting of

[8] A sample with a wide range of level of depressive symptoms was used, as we were interested in exploring the effects posture on interpretation bias, imagery, and emotion in a non-clinical sample with dysphoria (also in people who are not suffering currently depressive symptoms, but are at risk of developing them). People with severe depression were excluded in order to avoid including individuals with possible clinical depression.

21 items that measure the presence of depressive symptoms. Participants choose the statement that better describes their state in the last 2 weeks, including the current day. Items are rated from 0 to 3, depending on the chosen statement, and the total score ranges from 0 to 63. Standardized score ranges for categorical levels of depressive symptoms are: 0-13 (minimal depression), 14-19 (mild depression), 20-28 (moderate depression), and 29-63 (severe depression). The Spanish version (Sanz, Perdigón, & Vázquez, 2003) has shown high internal consistency in the general population (α = .87). In this sample, the internal consistency was also adequate (α = .89).

2.2.3. Interpretation bias: The Ambiguous Scenarios Test for depression-related interpretation bias (AST-D-II; Rohrbacher & Reinecke, 2014). The AST-D-II consists of two 15-item parallel versions, in which the items are ambiguous scenarios that allow either a positive or a negative interpretation (e.g., *"You are going to see a very good friend at the station. You have not seen them for years. You feel emotional, thinking about how much they might have changed"*). Items reflect the Beck's cognitive triad, that is, the tendency to make negative interpretations of ambiguous "future situations", "past experiences", or "situations concerning one's own skills and performance". Participant are instructed to imagine each situation as vividly as possible and to rate the level of pleasantness on a 11-point Likert scale, ranging from -5 (extremely unpleasant) to +5 (extremely pleasant). The emotional appraisal indicates the emotional valence of the interpretation or the interpretation bias. The two forms showed adequate psychometric properties, high parallel-test reliability (r = .79), and adequate internal consistency for each form (form "a": α = 0.77; form "b": α = 0.78) in a non-clinical sample. The two forms were presented in counterbalanced between conditions. A Spanish adaptation carried out by the authors was used, and showed an adequate internal consistency across administrations (α ranging from .74 to .81).

2.2.4. Mental imagery vividness: Prospective Imagery Task (PIT; Holmes, Lang, Moulds, & Steele, 2008; Stöber, 2000). The PIT measures the vividness with which individuals can imagine positive and negative events in their future, and comprises a list of 10 negative and 10 positive future events (e.g., *"You will have a serious disagreement with your friend", "Your will do well on your course"*). Participants are instructed to imagine each scenario happening to them and to rate the vividness of their image ("how clear and detailed the imaged is") on a 5-point Likert scale, ranging from 1 ("no image at all") to 5 ("very vivid"). Two composite indexes were calculated for the negative future scenarios (negative PIT), and the positive future scenarios (positive PIT). A Spanish adaptation performed by the authors was used. It showed adequate internal consistency across administrations (α ranging from .74 to .78 for negative PIT, and from .78 to .83 for positive PIT).

2.2.5. Happy, Sad, Optimistic, Hopeless, Anxious, Relaxed: Emotions' Scale (ES). Three positive emotions and three negative emotions were chosen by the authors. Participants were asked to rate to what extent they felt each emotion "right now/in the last few minutes" on a 5-point Likert scale (1 = not at all; 5 = extremely). Since the inter-item correlation between emotions were adequate in the pre-scores ($r > .20$) (Piedmont, 2014), except for "relaxed", two composite indexes were calculated for positive and negative emotions in order to reduce type error I. The internal consistency was adequate for negative ES (hopeless, anxious, sad) (α ranging from .59 to .70) and for positive ES (happy, optimistic) (α ranging from .84 to .89) across the administrations.

2.2.6. Fatigue, Vigor, and Depressive state: The Profile of Mood States (POMS, McNair, Lorr, & Droppleman, 1971). The subscales related to our hypothesis were used: fatigue (5 items; e.g., *"exhausted", "tired"*), vigor (5 items; e.g., *"energetic",*

"active"), and depression (5 items; e.g., *"unhappy", "sad"*). Participants were asked to rate to what extent they felt each emotion "right now/in the last few minutes" on a 5-point Likert scale (0 = not at all; 4 = extremely). The internal consistency of the Spanish short version validation (Andrade, Arce, de Francisco, Torrado, & Garrido, 2013) was adequate for all the subscales in a non-clinical sample (α ranging from .86 to .87). The internal consistency was adequate for fatigue (α ranging from .88 to .90), vigor (α ranging from .92 to .94), and depression (α ranging from .84 to .85) across the administrations.

2.2.7. Thoracic spine flexion. A smartphone with gyroscope was used to assess the curvature of the thoracic spine. An ad-hoc mobile application was developed to collect inertial data time series during the experiment. The smartphone was fixed on the participants' back at the thoracic spine level (T3-T4), between the scapulae, with an elastic band that surrounded the shoulders (Figure 1).

Figure 1. Upright and stooped posture adopted during the experiment

Note. This body manipulation was based on Mischalak et al. (2014).

2.3. Procedure

Upon arrival to the laboratory, to cover the main objective of the study, the researcher explained that the aim of the study was to validate a motion sensor that measures the flexion of the thoracic spine while people are doing different tasks (e.g., answering questionnaires). Participants filled out a sociodemographic questionnaire, the BDI-II[9], the AST-D-II, the PIT, the ES, and the POMS through an online survey tool.

Participants were randomly assigned using the Random Allocation Software 2.0 (Saghaei, 2004) to one of the two conditions: upright posture or stooped posture. Half of the participants (n = 28) were assigned to each condition. The manipulation of body posture was performed according to Michalak et al. (2014). The instructions for participants in the upright condition were: *"You should sit in a chair without tension in your legs or your feet, elevating your chin, with your back and neck straight, and bringing your shoulders back".* In contrast, the instructions for participants in the stooped condition were: *"You should sit in the chair without tension in your legs or your feet, dropping your head, letting your rib cage and shoulders fall, and stooping your back".* (see Figure 1).

To ensure the correct body posture in each condition, the laptop was placed at approximately 1 meter from the chair, at the eye level in the upright condition, and on the floor in the stooped condition. Participants were equipped with the smartphone as described and were required to hold a completely upright posture to calibrate the application. The inertial data registered in this posture was used the reference value for the inertial data recorded during the experiment. Participants adopted the upright or stooped body posture for a short period of time (2 minutes) (according to the procedure

[9] Participants filled in the BDI-II in the day of the experiment in order to assure that they met the first inclusion criterion (scoring ≤ 28 in the BDI-II).

used in other studies, such as Carney, Cuddy, & Yap, 2010; Cuddy, Wilmuth, Yap, & Carney, 2015) before answering the questionnaires. Next, they answered the AST-D-II, the PIT, the POMS, and the ES while continuing to hold the posture. Participants held the posture for approximately 15-20 minutes. The AST-D-II and the PIT were recorded with a female voice and were presented aurally[10] at both time points. Participants answered the AST-D-II and the PIT in a counterbalanced order. At the end of the study, participants were asked to explain the hypothesis they had regarding the objective of the study.

2.4. Data analyses

All statistical analyses were performed using the software package SPSS v.24. First, descriptive statistics, independent-samples t-tests, and chi-square tests were performed to test whether there were significant differences in sociodemographic variables (age, sex, marital status, education, work status and previous depressive episodes) and in the levels of BDI-II between conditions at baseline.

Second, to calculate the percentage of time that participants adopted an upright posture in each condition, the degree of inclination of the thoracic part of the back was calculated. This ranged from -2.81º to 37.96º for all the sample, where 0º was equivalent to sitting totally upright. Next, the median was calculated in order to separate the higher half of the sample from the lower half, and to generate an angle representing the upright posture and the stooped posture (as the median was 7.34º, the posture was considered as "upright" when the angle ranged from -2.81º to 7.33º, while it was considered as "not

[10] It was decided to use this kind of presentation for practical reasons (in order to not interfere with the body posture). However, the AST-D-II and the PIT are normally answered by reading the items, not hearing them.

upright" when the angle ranged from 7.34º to 37.96º)[11]. Subsequently, the percentage of time that the participant was in an angle equivalent to an upright posture was established. Once this percentage was calculated, an independent-sample t-test was performed to test whether there were significant differences in the posture manipulation measured by the mobile application. Inertial data of 5 participants, 2 in the upright condition and 3 in the stooped condition, were missed, and consequently they were not included in the analyses.

Third, to check the effects of the posture on AST-D-II, PIT, positive and negative ES, and the three factors of POMS (fatigue, depression, and vigor), ANCOVAs were carried out with condition as between-factor and baseline scores as covariates.

Fourth, to analyze the associations between the percentage of time upright and the change in the primary and secondary outcomes, Pearson's correlations were performed.

Finally, moderation analyses were carried out to examine whether the relationships between the condition (upright vs. stooped) and the post-scores in AST-D-II and PIT were moderated by the level of BDI-II. They were performed using the procedure described by Hayes (2013) from the macro PROCESS (version 2.16), choosing model 1. In these analyses, upright condition was coded as "1" and the stooped condition was coded as "2" (e.g., a negative relationship between condition and the AST-D-II post-scores meant that upright condition achieved higher AST-D-II post-scores). Pre-scores were entered as covariates of the dependent variables in each model. All the regression coefficients were reported in unstandardized form as *b*-values. Tests of significance ($p < .05$) or a confidence interval (not including zero) in the interaction "condition x BDI-II"

[11] The median of the sample of the present study was used to calculate the upright/no-upright posture of the participants. To our knowledge, there is no cut-offs in the literature that indicate which degree of inclination of the thoracic part of the back (measured by inertial technology fixed at the thoracic spine level) corresponds to an upright/stooped posture.

answered whether the BDI-II moderated the effect of condition on post-scores of AST-D-II or PIT. The conditional effects of condition on the post-scores of AST-D-II and PIT at medium (the mean), low (-1 *SD*), and high (+1 *SD*) levels of BDI-II were examined with the pick-a-point approach (or analysis of the simple slopes).

3. Results

3.1. Differences in sociodemographic variables and BDI-II

Descriptive statistics of sociodemographic variables and the BDI-II for each condition are shown in Table 1. There were no significant differences between conditions for age, $t(52) = 1.25$, $p = .216$, *Cohen's d* = 0.34; BDI-II, $t(52) = 0.18$, $p = .857$, *Cohen's d* = 0.05; sex, $\chi^2(1, N = 54) = 0.43$, $p = .513$; marital status, $\chi^2(2, N = 54) = 1.20$, $p = .681$; education, $\chi^2(2, N = 54) = 1.33$, $p = .574$; work status, $\chi^2(2, N = 54) = 1.54$, $p = .489$; or previous depressive episodes, $\chi^2(1, N = 54) = 0.26$, $p = .699$.

Table 1. Descriptive statistics for sociodemographic data and BDI-II.

	Upright condition (n = 26)	**Stooped condition** (n = 28)
Age (years) ***M (SD)***	22.50 (2.93)	21.54 (2.73)
Sex (% women)	69.2%	60.7%
Marital status (%)		
Single	57.7%	64.3%
Married	3.8%	0%
In a relationship	38.5%	35.7%
Education (%)	100%	100%
Undergraduate students	80.8%	85.7%
Postgraduate students	7.7%	10.7%
Ph.D. students	11.5%	3.6%
Work status (%)		
Student and employed	23.1%	14.3%
Student	76.9%	82.1%
Unemployed	0%	3.6%
Previous depressive episodes (% yes)	15.4%	10.7%
BDI-II ***M (SD)***	9.19 (7.81)	9.57 (7.54)

Note. BDI-II = Beck Depression Inventory-II.

3.2. Differences in the posture (thoracic spine flexion)

An independent-sample t-test showed that there were significant differences in the percentage of time that participants were upright in each condition, $t(47) = 8.81$, $p < .001$, *Cohen's d* = 2.52. Participants in the upright condition were 85.74% of the time in an

upright posture, while participants in the stooped condition were 14.15% of the time in an upright posture[12].

3.3. Effects of posture on AST-D-II, PIT, ES, and POMS

Descriptive statistics, ANCOVAs, and graphs of the effect of posture on AST-D-II, PIT, positive and negative ES, and POMS are shown in Table 2 and Figures 2 and 3. A main effect of condition was found for the AST-D-II, positive ES, and Vigor (POMS). Participants in the upright condition rated the ambiguous information as more pleasant, experienced more positive emotions (happy and optimistic), and felt more vigor than participants in the stooped condition. However, there were not main effects of condition for positive or negative PIT, negative ES, relaxation (ES), fatigue (POMS) and depression (POMS).

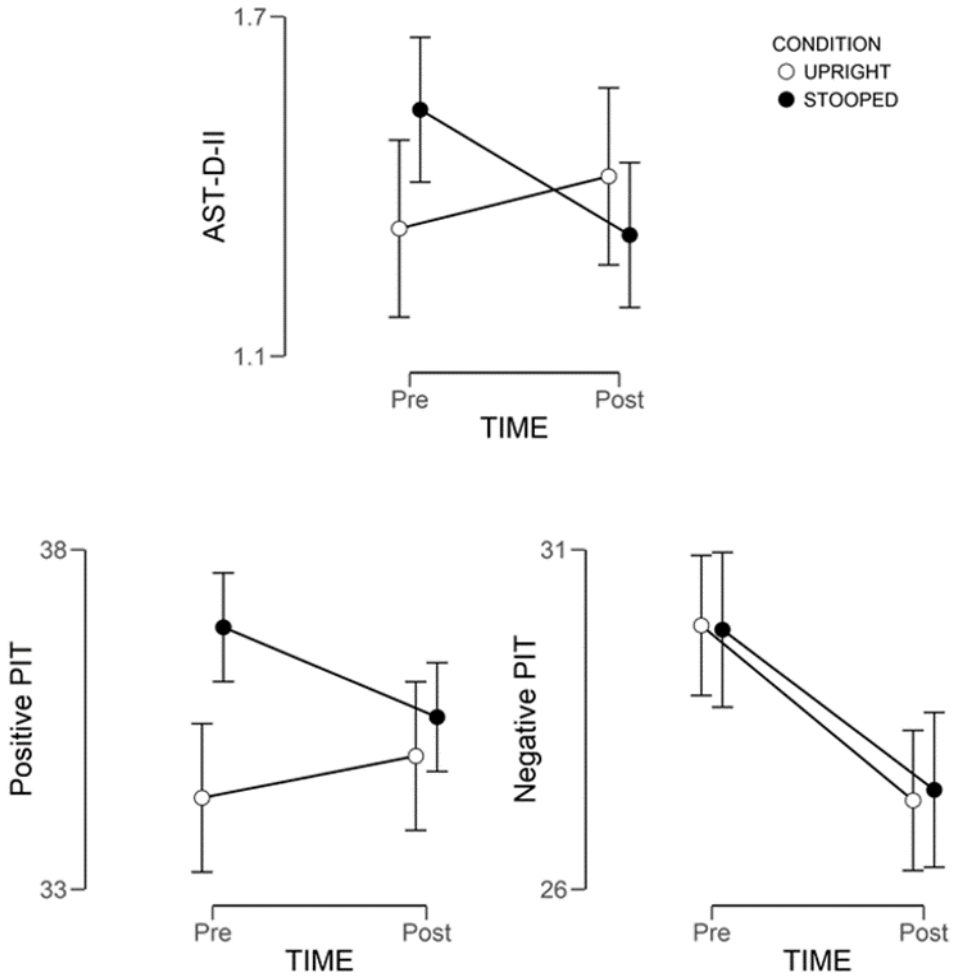
[12] This result is due to the fact that participants occasionally moved during the experiment (e.g., participants in the stooped condition occasionally straighten up or participants in the upright posture occasionally slumped). An independent-sample t-test also showed that there were significant differences in the direct score of the degree inclination of the back, $t(45) = 8.18$, $p < .001$, *Cohen's d* = 2.39. The degree of the inclination of the back was significantly more "upright" in the upright condition ($M = 3.67$; $SD = 3.80$) than in the stooped condition ($M = 19.40$; $SD = 8.43$)

Table 2. ANCOVAs results and values for AST-D-II, PIT, ES and POMS

	Upright condition (*n* = 26)		**Stooped condition** (*n* = 28)		**ANCOVAs** [a]		
	Pre *M(SD)*	**Post** *M(SD)*	**Pre** *M(SD)*	**Post** *M(SD)*	***F***	***p***	η_p^2
AST-D-II	1.33 (1.13)	1.42 (1.14)	1.54 (1.14)	1.31 (1.27)	$F(1,51) = 4.82$	.033	.09
PIT							
Positive	34.35 (9.29)	34.96 (8.71)	36.86 (5.63)	35.54 (7.48)	$F(1,51) = 3.87$	.055	.07
Negative	29.88 (8.14)	27.31 (8.67)	29.82 (6.34)	27.46 (7.36)	$F(1,51) = 0.04$	.840	.00
ES							
Negative (Hopeless, Anxious, Sad)	1.59 (0.73)	1.60 (0.60)	1.57 (0.59)	1.43 (0.61)	$F(1,51) = 1.97$	.167	.04
Positive (Happy, Optimistic)	3.19 (0.87)	3.17 (0.95)	3.38 (0.91)	2.98 (1.23)	$F(1,51) = 7.69$	.008	.13
Relaxed	3.54 (1.03)	3.35 (0.98)	3.32 (1.09)	3.68 (1.16)	$F(1,51) = 2.50$	.120	.05
POMS							
Fatigue	4.73 (4.21)	5.42 (4.09)	3.07 (3.87)	3.04 (3.97)	$F(1,51) = 2.61$	.112	.05
Depression	3.08 (3.60)	2.62 (3.09)	2.25 (3.40)	2.11 (3.52)	$F(1,51) = 0.14$	.715	.00
Vigor	9.08 (4.66)	8.92 (4.79)	8.89 (5.18)	7.54 (5.05)	$F(1,51) = 6.07$	.017	.11

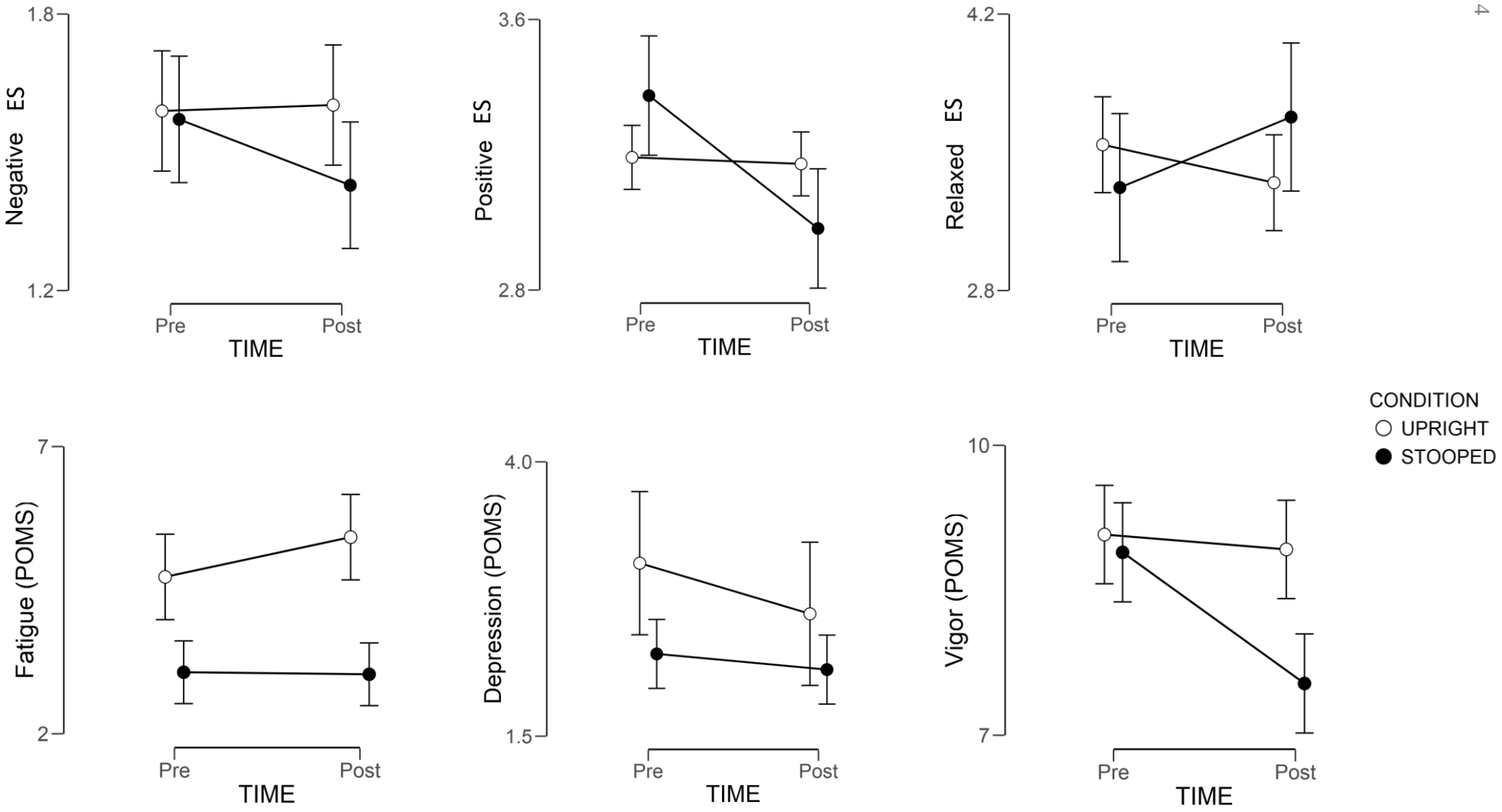
Note. [a] All ANCOVAs were adjusted for baseline scores. AST-D-II = Ambiguous Scenarios Test for depression-related interpretation bias; PIT = Prospective Imagery Task; ES = Emotions' Scale; POMS = The Profile of Mood States

Figure 2. Graphs of the effect of posture on AST-D-II and PIT scores.



Note. Error bars represent the 95% confidence interval of the mean. AST-D-II = Ambiguous Scenarios Test for depression-related interpretation bias; PIT = Prospective Imagery Task.

Figure 3. Graphs of the effect of posture on ES and POMS scores.



Note. Error bars represent the 95% confidence interval of the mean. POMS = The Profile of Mood States; ES = Emotions' Scale.

3.4. Relationship between percentage of time in an upright posture and change in AST-D-II, PIT, ES, and POMS.

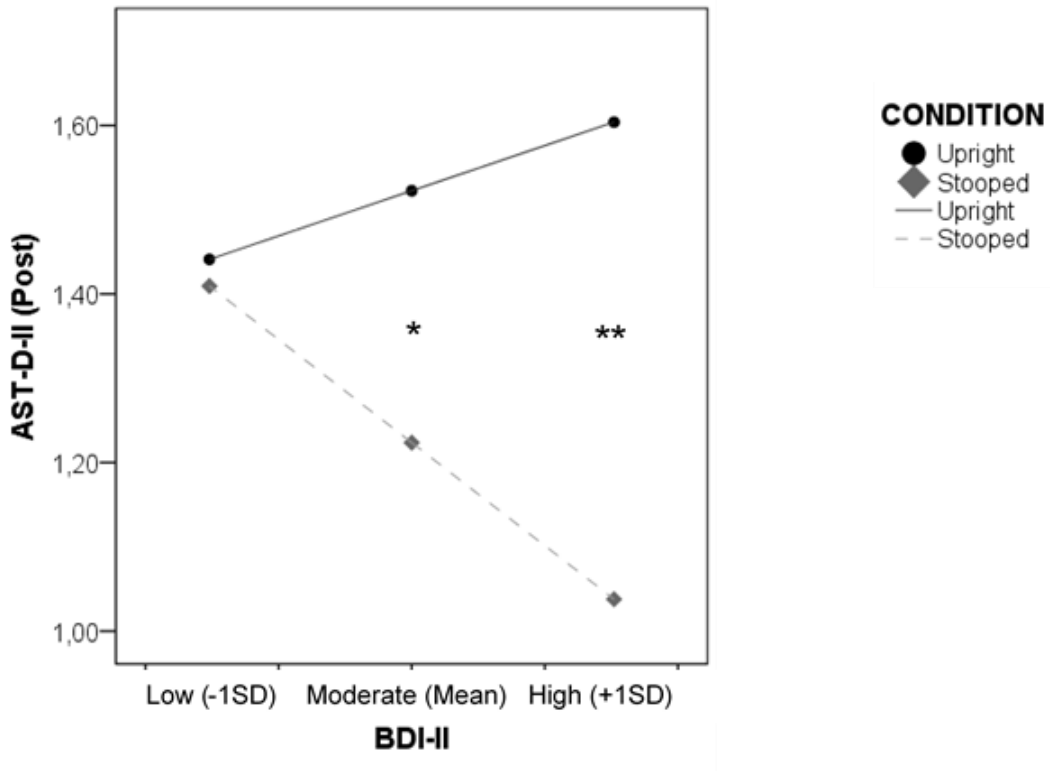
Pearson's correlation showed a positive significant relationship between the percentage of time in an upright posture and change in AST-D-II (r = .35, p = .014) and the change in positive PIT (r = .44, p = .002). However, the percentage of time in an upright posture was not correlated with change for the other variables: negative PIT (r = -.03, p = .826); negative ES (r = .17, p = .235); positive ES (r = .24, p = .101), relaxation (ES) (r = -.18, p = .228), fatigue (POMS) (r = .18, p = .205), depressive mood (POMS) (r = -.06, p = .679), or vigor (POMS) (r = .16, p = .266).

3.5. Depressive symptomatology as moderator: Does depressive symptomatology (BDI-II) moderate the effect of body posture on interpretation bias (AST-D-II) and mental imagery (PIT)?

Moderation analyses showed that the BDI-II moderated the effect of condition on the AST-D-II post-scores, but not the positive PIT post-scores, $F(1,49) = 0.08$, p = .785; or negative PIT post-scores, $F(1,49) = 0.08$, p = .783. With regards to the interpretation bias model (see Figure 3), the overall model explained 83.85 % of the variance in the AST-D-II post-scores, $F(4,49) = 79.77$, $p < .001$. The interaction between condition and BDI-II was significant, $F(1,49) = 4.75$, p = .034, meaning that BDI-II was a moderator of the effect of the condition on the AST-D-II post-scores, accounting for 1.24% of the variance. Analysis of simple slopes showed that there was a negative significant relationship between condition and the AST-D-II post-scores when the BDI-II was "medium", b = -0.30, 95% CI [-0.59, -0.01], t = -2.07, p = .044, and "high", b = -0.57, 95% CI [-0.91, -0.22], t = -3.27, p = .002. Participants in the upright condition (compared to the stooped condition) with higher BDI-II achieved higher scores in the AST-D-II post-

scores. Alternatively stated, the higher participants' levels of depression, the greater the impact the experimental manipulation had on interpretation of ambiguous information (see Figure 4)

Figure 4. Simple slopes graph of the regression of condition on the AST-D-II post-scores at three levels of the BDI-II (low, medium, high).



Note. BDI-II = Beck Depression Inventory-II. AST-D-II = Ambiguous Scenarios Test for depression-related interpretation bias. "Low", "medium" and "high" levels of the moderators represent the mean and ± 1 standard deviation (SD) (BDI: 9.39 ± 7.60). Significant p-values (* $p < .05$, ** $p < .01$) represent the level of the moderator in which the conditional effect of condition on AST-D-II post-scores is significant. Baseline score is entered as covariate.

4. Discussion

The main objective of this study was to analyze the effect of adopting an upright (vs. stooped) posture on the processing of ambiguous information and the ability to generate mental imagery. Secondary objectives study were to analyze the effects of posture on different depression-related emotions (e.g., sadness, happiness, vigor), as well as to explore the interplay between upright vs. stooped posture, interpretation bias, imagery ability, and emotions.

First, it was verified that there were significant differences between both conditions in the degree of inclination of the thoracic part of the back measured objectively with inertial technology, indicating that the posture of the body was manipulated successfully. Following this manipulation check, partial evidence was found for the first hypothesis of this study. Participants in the upright (vs. stooped) condition interpreted the ambiguous scenarios more positively after adopting their allocated posture. This result is in line with the results found by Mischalak et al. (2014), Wilson and Peper (2004) or Tsai et al. (2016), which highlighted the effect of posture in cognitive bias processes. Significant differences were not found between conditions in terms of the ability to imagine negative or positive scenarios, although visual inspection of the graph indicates that the lack of a statistically significant difference could reflect insufficient power for this particular measure.

The second hypothesis was partially supported, as participants in the upright (vs. stooped) condition experienced more positive emotions (happiness and optimism), and felt more vigor after the posture manipulation. However, significant between-group differences were not found for relaxation, negative emotions, fatigue or depressive state. This result suggests that the upright posture (vs. stooped) has more effects on positive emotions than on negative emotions, as was found in other studies, such as Wilkes et al.

(2017). It is also important to highlight the non-significant differences in "relaxation" between conditions, as it indicates that the differences in the primary outcome (interpretation bias) are unlikely to be due to the possible "pleasantness" of one posture over the other. According to the direct mechanism of body on mental states proposed by Körner et al. (2015), it is possible that the upright posture (vs. stooped) directly influences "positive" ways of processing information or feeling, but not "negative" ways of processing or feeling. This finding may have important clinical implications in the treatment of depressed people, as postural changes may help to change two symptoms that are relevant in the diagnosis of major depression (American Psychiatric Association, 2013): the lack of positive emotions and/or vigor.

The third hypothesis was also partially supported. The greater the percentage of time participants were in the upright position, the greater the change in interpretation bias and increase in vividness of imagined positive scenarios. According to the ICS approach (Barnard & Teasdale, 1991; Teasdale & Barnard, 1993), we suggest that the more time the "body state subsystem" is receiving positive inputs from the posture (e.g., upright posture), the more the positive effects on the "implicational subsystem" (e.g., more positive global view of themselves), leading to interpreting the ambiguous information more positively or imagining the positive scenarios more vividly. However, the percentage of time in an upright position does not seem to be associated with changes in positive or negative emotions. Given that the effect of condition on positive emotions was statistically significant (second hypothesis), we can speculate that it is not necessary to maintain an upright posture for a long period of time to change positive emotions to a greater extent. However, further studies are required to test this explanation.

In addition, it was found that participants in the upright (vs. stooped) condition with higher levels of depressive symptomatology (at least "mild" scores in the BDI-II

questionnaire) interpreted the ambiguous scenarios more positively after adopting the posture. Thus, this result implies that the effect of posture on interpretation bias is especially relevant for people with depressive symptoms. Following the ICS approach (Barnard & Teasdale, 1991; Teasdale & Barnard, 1993), it is suggested that when individuals with higher levels of depressive symptomatology hold an upright position, they receive "positive" proprioceptive feedback from the body, and the negative feedback loop between subsystems is disrupted. Consequently, individuals start to process the ambiguous information more positively. The ICS approach has also been applied to understand the therapeutic effects of mindfulness on depression (Teasdale, Segal, & Williams, 1995). However, the level of depressive symptomatology did not moderate the effect of posture on vividness of positive imagery, suggesting the levels of depressive symptomatology does not have a relevant role in the effect of posture on generation of positive imagery.

This study has theoretical implications, as it supports the theories of embodied emotion and cognition, that is, the role of the body in emotional and cognitive processes (e.g., Winkielman et al., 2015). In this regard, this study also highlights the importance of including the body's role in the cognitive models of depression, as the findings point out that posture interacts with the mechanisms that Holmes et al. (2009) suggest are involved in the maintenance of depression.

Limitations of this study should be noted. First, the study was carried out with a non-clinical sample, so the results are not necessarily generalizable to clinical depressed samples. Nevertheless, the results of the moderation analysis point out that the effect of posture is stronger at higher symptoms of depression. Subsequently, future studies should explore whether the upright posture helps in processing information in a more positive way and in imagining positive scenarios more vividly amongst individuals with major

depression. Second, the effects of posture on these mechanisms were not verified in the mid- or in the long-term. Longitudinal studies would help to clarify how long this effect lasts. Third, this study did not have a condition of individuals adopting their usual posture. Such a condition would help to distinguish whether the upright posture has benefits over the usual posture that individuals adopt.

These findings may have clinical implications, as results suggest that manipulating posture may modify mechanisms that are involved in the onset and maintenance of depression. In this sense, it could be relevant to include the manipulation of the body during the interventions such as those using cognitive bias modification (CBM) procedures, which aim to modify interpretation biases. CBM-based interventions aim to modify information-processing biases through a computerized repeated practice that reinforces a more positive style of information processing, in which participants repeatedly practice imagining positive resolutions for ambiguous situations (e.g., Blackwell & Holmes, 2010; Lang, Blackwell, Harmer, Davison, & Holmes, 2012; Blackwell et al., 2015; Rorhrbacher, Blackwell, Holmes, & Reinecke, 2014). Hence, future studies should explore the effects of manipulating body posture while completing a session or sessions of positive imagery CBM.

In conclusion, this study indicates that body posture interacts with mechanisms involved in the etiology and maintenance of depression (e.g., interpretation bias and imagery ability), as well as with depression-related emotions (e.g., happiness, optimism, and vigor). Adopting an upright (vs. a stooped) posture had positive effects in processing ambiguous information. These results were corroborated by an objective measurement (assessed by inertial technology) indicating that the percentage of time in an upright position was associated with the change in the interpretation bias, as well as with the vividness with which positive scenarios were imagined. Additionally, adopting an upright

(vs. stooped) posture increased positive emotions. Finally, the level of depressive symptomatology moderated the effect of posture on the change in interpretation bias. This study has theoretical and clinical implications that should be continued explored in order to clarify the role of the body posture in depression.

5. References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. Arlington, VA: American Psychiatric Association.

Andrade, E., Arce, C., De Francisco, C., Torrado, J., & Garrido, J. (2013). Versión breve en español del cuestionario POMS para deportistas adultos y población general [Abbreviated version in Spanish of the POMS questionnaire for adult athletes and general population]. *Revista de psicología del deporte*, *22*(1), 59-102.

Barnard, P. J., & Teasdale, J. D. (1991). Interacting cognitive subsystems: A systemic approach to cognitive-affective interaction and change. *Cognition & Emotion*, *5*(1), 1-39. doi: 10.1080/02699939108411021

Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, *59*, 617-645. doi: 10.1146/annurev.psych.59.103006.093639

Blackwell, S. E., Browning, M., Mathews, A., Pictet, A., Welch, J., Davies, J., ... & Holmes, E. A. (2015). Positive imagery-based cognitive bias modification as a web-based treatment tool for depressed adults: a randomized controlled trial. *Clinical Psychological Science*, *3*(1), 91-111. doi: 10.1177/2167702614560746

Blackwell, S. E., & Holmes, E. A. (2010). Modifying interpretation and imagination in clinical depression: A single case series using cognitive bias modification. *Applied Cognitive Psychology*, *24*(3), 338-350. doi: 10.1002/acp.1680

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck Depression Inventory Manual.* San Antonio, TX: The Psychological Corporation.

Carney, D. R., Cuddy, A. J., & Yap, A. J. (2010). Power posing: Brief nonverbal displays affect neuroendocrine levels and risk tolerance. *Psychological science*, *21*(10), 1363-1368. doi: 10.1177/0956797610383437

Clark, D. A., Beck, A. T., & Alford B.A. (1999). Scientific foundations of cognitive theory and therapy of depression. New York: Wiley.

Cuddy, A. J., Wilmuth, C. A., Yap, A. J., & Carney, D. R. (2015). Preparatory power posing affects nonverbal presence and job interview performance. *Journal of Applied Psychology*, *100*(4), 1286. doi: 10.1037/a0038543

Everaert, J., Koster, E. H., & Derakshan, N. (2012). The combined cognitive bias hypothesis in depression. *Clinical psychology review*, *32*(5), 413-424. doi: 10.1016/j.cpr.2012.04.003

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, *39*(2), 175-191.

Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: current status and future directions. *Annual review of clinical psychology*, *6*, 285-312. doi: 10.1146/annurev.clinpsy.121208.131305

Hayes, A. F. (2013). *Introduction to Mediation, Moderation, and Conditional Process Analysis. A Regression-Based Approach.* New York: Guilford.

Holmes, E. A., Blackwell, S. E., Burnett-Heyes, S., Renner, F., & Raes, F. (2016). Mental imagery in depression: phenomenology, potential mechanisms, and treatment implications. *Annual review of clinical psychology*, *12*, 249-280. doi: 10.1146/annurev-clinpsy-021815-092925

Holmes, E. A., Lang, T. J., & Deeprose, C. (2009). Mental imagery and emotion in treatment across disorders: Using the example of depression. *Cognitive Behaviour Therapy*, *38*(S1), 21-28. doi: 10.1080/16506070902980729

Holmes, E. A., Lang, T. J., Moulds, M. L., & Steele, A. M. (2008). Prospective and positive mental imagery deficits in dysphoria. *Behaviour research and therapy*, *46*(8), 976-981. doi: 10.1016/j.brat.2008.04.009

Ingram, R. E. (1984). Toward an information-processing analysis of depression. *Cognitive therapy and research*, *8*(5), 443-477. doi: 10.1007/BF01173284

Joormann, J., Yoon, K. L., & Zetsche, U. (2007). Cognitive inhibition in depression. *Applied and preventive psychology*, *12*(3), 128-139. doi: 10.1016/j.appsy.2007.09.002

Körner, A., Topolinski, S., & Strack, F. (2015). Routes to embodiment. *Frontiers in psychology*, *6*, 940. doi: 10.3389/fpsyg.2015.00940

Lang, T. J., Blackwell, S. E., Harmer, C. J., Davison, P., & Holmes, E. A. (2012). Cognitive bias modification using mental imagery for depression: developing a

novel computerized intervention to change negative thinking styles. *European Journal of Personality*, *26*(2), 145-157. doi: 10.1002/per.855

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology*, *1*, 167-195. doi: 10.1146/annurev.clinpsy.1.102803.143916

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Profile of mood state manual*. San Diego, CA: Educational and Industrial Testing Service.

Michalak, J., Mischnat, J., & Teismann, T. (2014). Sitting posture makes a difference—embodiment effects on depressive memory bias. *Clinical psychology & psychotherapy*, *21*(6), 519-524. doi: 10.1002/cpp.1890

Nair, S., Sagar, M., Sollers III, J., Consedine, N., & Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology*, *34*(6), 632. doi: 10.1037/hea0000146

Niedenthal, P. M. (2007). Embodying emotion. *Science*, *316*(5827), 1002-1005. doi: 10.1126/science.1136930

Piedmont, R. L. (2014). Inter-item correlations. In Michalos, A.C. (Ed.), *Encyclopedia of quality of life and well-being research* (pp. 3303-3304). Dordrecht, The Netherlands: Springer.

Rohrbacher, H., Blackwell, S. E., Holmes, E. A., & Reinecke, A. (2014). Optimizing the ingredients for imagery-based interpretation bias modification for depressed mood: Is self-generation more effective than imagination alone?. *Journal of affective disorders*, *152*, 212-218. doi: 10.1016/j.jad.2013.09.013

Rohrbacher, H., & Reinecke, A. (2014). Measuring change in depression-related interpretation bias: development and validation of a parallel ambiguous scenarios test. *Cognitive behaviour therapy*, *43*(3), 239-250. doi: 10.1080/16506073.2014.919605

Saghaei, M. (2004). Random allocation software for parallel group randomized trials. *BMC medical research methodology*, *4*(1), 26. doi: 10.1186/1471-2288-4-26

Sanchez, A., Duque, A., Romero, N., & Vazquez, C. (2017). Disentangling the Interplay Among Cognitive Biases: Evidence of Combined Effects of Attention, Interpretation and Autobiographical Memory in Depression. *Cognitive Therapy and Research*, 1-13. doi: 10.1007/s10608-017-9858-5

Sanz, J., Perdigón, A. L., & Vázquez, C. (2003). Adaptación española del Inventario para la Depresión de Beck-II (BDI-II): 2. Propiedades psicométricas en población general [Spanish adaptation of the Beck-II Depression Inventory (BDI-II): 2.

Psychometric properties in the general population]. *Clínica y Salud, 14*(3), 249-280.

Stöber, J. (2000). Prospective cognitions in anxiety and depression: Replication and methodological extension. *Cognition & Emotion, 14*(5), 725-729. doi: 10.1080/026999300501176 93

Teasdale, J. D., & Barnard, P. J. (1993). *Affect, cognition, and change: Re-modelling depressive thought.* Hillsdale, N.J: Lawrence Erbaulm Associates.

Teasdale, J. D., Segal, Z., & Williams, J. M. G. (1995). How does cognitive therapy prevent depressive relapse and why should attentional control (mindfulness) training help?. *Behaviour Research and therapy, 33*(1), 25-39. doi: 10.1016/0005-7967(94)E0011-7

Tsai, H. Y., Peper, E., & Lin, I. M. (2016). EEG patterns under positive/negative body postures and emotion recall tasks. *NeuroRegulation, 3*(1), 23. doi: 10.15540/nr.3.1.23

Veenstra, L., Schneider, I. K., & Koole, S. L. (2016). Embodied mood regulation: the impact of body posture on mood recovery, negative thoughts, and mood-congruent recall. *Cognition and Emotion,* 1-16. doi: 10.1080/02699931.2016.1225003

Wilkes, C., Kydd, R., Sagar, M., & Broadbent, E. (2017). Upright posture improves affect and fatigue in people with depressive symptoms. *Journal of behavior therapy and experimental psychiatry, 54*, 143-149. doi: 10.1016/j.jbtep.2016.07.015

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1988). *Cognitive psychology and emotional disorders*. New York: John Wiley & Sons.

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1997). *Cognitive psychology and emotional disorders*. Chichester: John Wiley & Sons.

Wilson, V. E., & Peper, E. (2004). The effects of upright and slumped postures on the recall of positive and negative thoughts. *Applied psychophysiology and biofeedback, 29*(3), 189-195. doi: 10.1023/B:APBI.0000039057.32963.34

Winkielman, P., Niedenthal, P. M., Wielgosz, J., Eelen, J., & Kavanagh, L. C. (2015). Embodiment of cognition and emotion. In M. Mikulincer, P. R. Shaver, E. Borgida, & J. A. Bargh (Eds.), *APA handbooks of psychology, APA handbook of personality and social psychology, Vol. 1: Attitudes and social cognition* (pp. 151-175). Washington DC, USA: American Psychological Association.

World Health Organization (2017). *Depression and Other Common Mental Disorders: Global Health Estimates.* Geneva: World Health Organization.

CHAPTER 5. General Discussion

1. Summary of the main findings

As presented throughout this dissertation, bodily processes are valuable sources of information that contribute to shaping our emotions and thoughts. However, the embodied effects in the field of psychopathology and clinical psychology have been understudied. This situation, in turn, could keep evidence-based therapies from benefiting from body-related strategies that could enrich and improve their current therapeutic outcomes. Arising from the need to fill this gap in the scientific literature, this dissertation was born to shed light on how body-related strategies –and specifically, body posture manipulations– can be part of the therapy.

Hence, the main objective of this dissertation was to analyze the influence of adopting expansive and upright (vs. contractive and stooped) postures on several cognitive and emotional responses. More specifically, the four general objectives were: (1) to analyze the effects of adopting expansive and upright (vs. contractive and stooped) postures before and during the exposure to different anxiety-provoking stimuli (associated with social anxiety and eating disorders) on cognitive and emotional processes; (2) to investigate the effects of adopting an upright (vs. stooped) posture on changing two mechanisms associated with the maintenance of depression (cognitive bias interpretation and abnormalities in mental imagery) and related emotions; (3) to explore the possible moderator and mediator variables of these effects in order to answer *for whom* and *how* the effects of posture on different outcomes are produced; and (4) to clarify the possible clinical applications of the manipulation of the body posture in therapy.

To do so, three experiments were carried out. In the following subsections, a general discussion will be presented, putting together all the results derived from these studies.

1.1. Effects of postures on the exposure to anxiety-provoking stimuli

Study 1 and study 2 were aimed at analyzing the role of expansive and upright (vs. contractive and stooped) postures during the exposure to anxiety-provoking stimuli. In the case of study 1, women with fear of public speaking were exposed to an audience; and in the case of study 2, women with body dissatisfaction were exposed to their own bodies. Both studies were conducted sequentially, and study 1 helped in making decisions to design study 2, regarding when to adopt the posture and for how long.

Results of study 1 allowed us to conclude that adopting an expansive and upright (vs. contractive and stooped) posture *during* the exposure anxiety-provoking stimuli did not generate significant differences in terms of affect or thoughts (only in reducing negative thoughts). Indeed, a great percentage of the participants considered that the posture did not help them to deal with the stressful task, constituting an impediment. Indeed, as Carney, Cuddy, and Yap (2015) concluded, adopting a forced or unnatural posture for too long may generate discomfort, feelings of awkwardness, or even habituation to the effects of the posture. Individuals in study 1 held the posture for around 15-25 minutes, which could have been excessive. Although it can seem counterintuitive, in the case of holding a posture, our findings suggest that "less is more". That is, maintaining the same "forced" posture for too long may have negative consequences or no consequences.

Moreover, as discussed in study 1, the meaning individuals give to the posture plays a relevant role in shaping its psychological effects. An expansive and upright posture may be considered a sign of dominance or social success (Weisfeld & Beresford, 1982). However, in individuals with social anxiety, the use of the expansive posture in competitive situations may be interpreted as a provocation or a way to compete or threaten other "dominant" individuals (Gilbert, 2001). In addition, it must be added that the sample

was composed only of women, in whom the expansive postural effects seem to be different from the effects in men in a negative way (Roberts & Arefi-Afshar, 2007). Thus, the posture adopted by the women could have induced self-objectification, as the expansive and upright posture means that the sternum and breasts are spotlighted. In this direction, Kozak, Roberts, and Patterson (2014) demonstrated that the upright posture only functioned positively in terms of performing a cognitive task in a low self-objectification situation.

By contrast, adopting an expansive and upright posture (vs. contractive and stooped) *before* the speech generated positive significant differences in terms of affect or thoughts (lower negative thoughts, as well as lower negative affect in the case of women with higher fear or public speaking). As a result of these findings, a second experiment was designed where the posture was adopted for a short period of time (2 minutes), and only before exposure to their own body. Thus, results from study 2 point out that the expansive and upright (vs. contractive and stooped) posture generates positive outcomes in several body-related variables (body image state, negative emotions related to the body, and appraisal of one's own body) via the change in positive emotions. Consequently, in study 2, the posture could act as a mood induction procedure of positive emotions (Zhang, Yu, & Barrett, 2014).

Based on the results derived from both studies, it can be concluded that the expansive and upright (vs. contractive and stooped) postures should be used *before* the exposure to anxiety-provoking stimuli (at least in the case of women). Consequently, the results suggest that the expansive posture seems to be a promising strategy that could be combined with the exposure technique in the exposure to stressful stimuli in samples with different fears. Adopting the expansive and upright posture helped to reduce negative thoughts and negative affect before a speech (in the case of women with higher fear of

public speaking), and to improve several body-related outcomes after being exposed to their own body (in the case of women with high body dissatisfaction).

Hence, findings suggested that the expansive posture shapes the psychological experience of women, making them "feel and think less negatively" before the exposure (in the case of public speaking), as well as making them "feel and think more positively" after the exposure (in the case of body dissatisfaction). Findings derived from study 1 and 2 suggest that adopting an expansive and upright posture could be used as a mood induction procedure or, in other words, as a technique to evoke a required emotional experience (e.g., being more prepared or empowered to deal with the situation).

1.2. Effects of posture on mechanisms associated with the maintenance of depression and related emotions.

The second objective of this dissertation was reached through study 3, which included a non-depressed sample, but with a broad range of depressive symptomatology. This study indicated that body posture interacts with mechanisms involved in the maintenance of depression (interpretation bias and imagery ability), as well as with depression-related emotions. Individuals who adopted the upright (vs. stooped) posture interpreted ambiguous information more positively and experienced more positive emotions (happiness, optimism, and vigor) after adopting the allocating posture. Thus, as in the case of study 2, the upright (vs. stooped) posture seems to be related to the increase in positive emotions and cognitions, making individuals "feel and think more positively". As proposed by Koole and Veenstra (2015), findings in study 3 suggest that posture can be used as a strategy to regulate emotions implicitly, that is, as a process aimed at changing the quality, intensity, or duration of an emotional response, without explicit intentions.

Moreover, the results showed that the greater the percentage of time the individuals were in an upright posture, the more changes in cognitive bias interpretation and vividness of positive imagery were found. In the case of study 3, individuals maintained the posture for approximately 15-20 minutes. This finding could seem to contradict our previous conclusions about "less is more" in the case of maintaining the posture. However, from our point of view, in studies 1 and 2, the posture was used to induce a more adaptive mindset for dealing with a stressful situation. By contrast, in the case of study 3, individuals did not have to deal with a stressful situation. They had to carry out a cognitive bias-related task, as in the studies conducted by Michalak, Mischnat, and Teismann (2014) or Wilson and Peper (2004). Thus, the only task that they had to do consisted of answering self-reports while they were reproducing the habitual and non-habitual body posture commonly adopted by individuals diagnosed with depression (Michalak et al., 2009). Hence, in this study the length of time holding a posture did not interfere with changing emotions and cognitions. In fact, the results derived from the inertial technology showed that the more time spent holding an upright (vs. stooped) posture, the more benefits were achieved in modulating cognitive bias, as well as in improving positive imagery. Thus, it could be concluded that the length of time adopting an upright posture does not interfere negatively when posture is used to regulate emotional and cognitive processes associated with depression during a not stressful task.

1.3. Mediator and moderator variables of the effects of posture

For whom? and *how?* are important questions that need to be answered in any field of psychology. It is necessary to understand which individuals can benefit more from specific techniques or how an effect is produced, as it will allow us to conduct more

effective and efficient therapies. Indeed, in the field of embodied cognition, Carney et al. (2015) encourage the identification of moderators of the embodied effects of posture.

Regarding *for whom* the effects of posture have more positive effects on cognition and emotion. In study 1 and study 3, the findings highlight that the individuals who benefited more from the embodied effects of posture were those with higher levels of symptomatology (fear of public speaking and depressive symptoms). This finding has important clinical implications because the more symptoms are experienced, the more powerful the expansive and/or upright postures are in producing positive cognitive and emotional responses (compared to adopting a stooped and contractive posture). Consequently, results point out that individuals suffering from higher symptoms could be the "target population" in which the adoption of an expansive and upright posture should be encouraged, or a contractive and stooped posture should be avoided.

In study 2, the effect of the body mass index (BMI) was analyzed as a moderator variable in the relationship between posture and body-related outcomes. An initial moderation analysis showed that the women with lower BMI benefited the most from adopting an expansive and upright posture. However, this effect disappeared in a more complex analysis that integrated another variable acting as a mediator responsible for this embodied effect: the change in positive emotions. This finding is related to *how* these effects are produced. Thus, in the case of study 2, the expansive and upright (vs. contractive and stooped) posture induced positive emotions (a combination of happiness and self-confidence), and in turn, led to improvements in several body-related outcomes, such as body image, negative emotions, or appraisal of the person's own body. These results were derived from an exploratory analysis, but they can help to disentangle an important issue. According to Körner, Topolinski, and Strack (2015), the underlying mechanism that could be acting in these findings is the *direct state induction*. According

to this mechanism, body posture could directly alter individuals' feelings, acting as a mood induction procedure of positive emotions, which led to increasing all the body-related outcomes of this study. Thus, leaving the women alone by themselves while adopting the posture for a few minutes would have induced their self-confidence or feelings of success, which are universally associated with the upright and expansive posture, a connection that can be phylogenetically shaped.

By contrast, the reason for not finding positive results in study 1 at the moment the women were facing the stressful situation (during the speech), may be that other mechanisms identified by Körner et al. (2015) could be involved, such as *modal priming*. Thus, adopting an expansive posture in front of the audience when giving a speech could have increased the accessibility to associated concepts. Considering that these associated concepts are idiosyncratic and depend on biographical factors, and according to Gilbert's (2001) theory, individuals with high fear of speaking in public could have activated abstract concepts related to dominance or control *over* others –which would translate into negative emotions and cognitions–. This raises a new question because the concepts associated with bodily states may be changed through the learning experience. Hence, there is still room for improvement and to take advantage of the positive effects of the expansive posture during the anxiety-provoking situation, and more research is needed to answer the following questions: What would happen if the concepts associated with the expansive posture in threatening situations were changed by others that fit reality better? What would be the outcomes if the therapist performed previous psychoeducation before manipulating the posture?

1.4. The possible clinical implication of the body posture in therapy

The body has been understudied in cognitive-behavioral therapy (CBT) since their common strategies that employ the body has been mainly limited to reducing the physiological response (e.g., diaphragmatic breathing or progressive muscular relaxation). However, other body strategies that could also help to change the emotional and cognitive responses are barely used. Indeed, the facial expression, the body movements, or the posture that patients adopt within or between sessions are generally ignored. For instance, a clinical therapist may be aware of the body posture of his/her patients –which tends to be stooped or slumped– or their facial expression –which tends to be sad and frowning– while they are doing cognitive restructuring. However, because manipulating the body is not the aim of the therapy, it is more likely that the therapist will not "correct" the patient's posture. From our point of view, this is due to the lack of research in the field of embodied cognition applied to clinical psychology. Hence, an open question grounded in the embodied cognition theories is: What would happen if the body posture of a patient were changed while using other cognitive-behavioral techniques?

This dissertation does not allow us to fully answer these questions because the studies are not conducted in a clinical therapeutic context with clinical samples. However, the studies allow us to make an attempt to describe how the body can be included in therapy. On the one hand, therapists could recommend that patients adopt an expansive and upright posture before dealing with an exposure session for a short period of time in order to empower themselves. Nevertheless, as previously discussed in study 1 and study 2, it is necessary to test whether these affective and cognitive changes during the exposure have negative or positive consequences for the therapy in the mid- and long-term (e.g., Does the posture impede a necessary negative response during exposure? Does the posture increase the adherence to the exposure technique? Does the posture increase the

self-confidence to deal with a stressful situation?). On the other hand, therapists could correct the posture of their patients during the session, especially when they are working on changing cognitive bias and depression-related emotions. Thus, the posture could act as a strategy to regulate the emotions and facilitate the change in cognitive bias more easily. In order to shed more light on how the posture can be included in therapy to change cognitive bias modification, our research group is carrying out a new study that is currently in progress.

In this novel study, the posture is manipulated while individuals with mild to moderate depression symptomatology are receiving a positive imagery Cognitive Bias Modification (CBM). As briefly mentioned in the discussion of study 3, CBM aims to modify information-processing biases through a computerized repeated practice that reinforces a more positive style of information processing (e.g., Blackwell & Holmes, 2010; Lang et al., 2012; Blackwell et al., 2015). This training uses ambiguous scenarios at the beginning that have positive outcomes at the end, and the underlying rationale is that the repeated practice may automatically lead to making more positive resolutions in ambiguous situations in daily life. In our study in progress, two conditions are included (upright and stooped posture), and the individuals maintain the posture while they are receiving the CBM. Given the results of study 3, there are two competing possibilities in the expected results. One possibility is that the adoption of an upright (vs. stooped) body posture will strengthen the vividness of the positive scenarios, enhancing the effects of the positive imagery CBM on several outcomes (e.g., interpretation bias, positive emotions, etc.). However, another possibility is that adopting an upright position will make individuals interpret the ambiguous part of the scenario more positively. Consequently, this could reduce the amount of learning derived from the CBM because they are "less surprised" by the positive resolutions of the scenarios (e.g., if they do not

experience ambiguity during the training, they do not learn to disambiguate in a positive way). In this regard, the findings derived from the study conducted by Clarke, Nanthakumar, Notebaert, Holmes, Blackwell, and MacLeod (2014) highlight the need for the scenarios to be ambiguous in order to achieve the effectiveness of the CBM.

2. Strengths

For our point of view, this dissertation has several strengths that add robustness to the main findings:

- The dissertation consists of three inter-group randomized experimental studies, with *a priori* calculated sample sizes, which meet the indispensable requirements to achieve an adequate internal validity –the extent to which a causal relationship can be inferred among variables– (Roth & Fonagy, 2013).
- The dissertation involved research in a novel field in experimental and clinical psychology, which fills an important gap in a field in the scientific literature where several authors have pointed to the need for more research.
- The dissertation has made an attempt to disentangle *at what moment* and *for how long* the posture should be adopted; as well as *how* the embodied effects of posture are produced, and *for whom* the effects of posture are more powerful in changing emotional and cognitive processes.
- Different postural sensors with inertial technology have been developed to monitor the upright/stooped posture and the expansive/contractive posture more objectively. Only a handful of studies have used postural sensors in embodied cognition studies (e.g. Michalak et al., 2015), and to our knowledge, studies 2 and 3 are the first studies in the literature to include sensors to monitor posture.

3. Limitations

Nevertheless, this dissertation is not exempt from limitations. The individual discussion of each study has explained the specific limitations, but this subsection will list all the common limitations of the three studies:

- The three studies were conducted with non-clinical samples (University students), and consequently, the findings are not completely generalizable to other clinical samples, such as Social Anxiety Disorder, Eating Disorders, or Major Depression.
- There are limitations in generalizing the findings of study 1 and 2 to men, as they were conducted only with women. Study 3 was conducted with men and women because the stooped posture has been associated with depression in both sexes indistinctly (Michalak et al., 2009). Nevertheless, in the case of studies 1 and 2, where a stressful task had to be performed, adopting an expansive and upright posture could act differently because several contextual variables are involved (Kozak et al., 2014; Roberts & Arefi-Afshar, 2007), and including men in this study could have distorted the results. Although this has the limitations of impeding the generalization of the findings to men, the study with women helped to study the effect of posture in depth, removing sex as a possible confounding variable.
- The three studies were carried out in a laboratory context, not in a clinical context, which represents a threat to external validity –the extent to which the causal relationship can be generalized–. The studies were carried out with a highly homogeneous and selected sample (e.g., meeting specific inclusion and exclusion criteria), in which the individuals had to carry out tasks that were "simulating" the techniques used in a clinical context. Although these controlled variables help to

gain internal validity, they constitute a threat to the external validity (Roth & Fonagy, 2013).

- The studies do not include the "usual" or "natural" posture as a control condition, as in other studies (e.g., Davis et al., 2017; Wilkes, Kydd, Sagar, & Broadbent, 2017). This condition would help to figure out whether the expansive and upright postures have greater effects than the natural posture. Nevertheless, we followed the strategy of other studies by including only the expansive/upright and contractive/stooped condition (e.g., Cuddy, Wilmuth, Yap, & Carney, 2015; Michalak et al., 2014; Veenstra, Schneider, & Koole, 2016), as our main question was to explore *which posture* is the most beneficial to change emotions and cognition in specific situations.
- The postural sensors developed in study 2 and study 3 are not still validated. Hence, the data should be considered carefully because this is only a first attempt to quantitatively and objectively measure the posture of the body.
- The physiological responses are not measured in any study in the present dissertation, and consequently, the role of these responses in the embodied effects of posture has not been studied. Other studies have identified the influence of posture in changing physiological responses (e.g., arousal, hormones, etc.) (Carney, Cuddy, & Yap, 2010; Nair, Sagar, Sollers, Consedine, & Broadbent, 2015), but not their role. Physiological responses related to muscular, neuroendocrine, or autonomic nervous systems may be possible mechanisms through which the posture has an effect on emotional and cognitive processes (Nair et al., 2015). In this regard, a review conducted by Kreibig (2010) showed that the autonomic nervous system is viewed as a major component of the emotional response in many recent theories of emotion. Hence, understanding the

effect that the posture generates in the autonomic response could be key in understanding how this direct emotional induction observed in the results is produced. Nevertheless, evidence suggests that autonomic arousal responses are not the only processes responsible for these emotional changes (Laird & Lacasse, 2014).

4. Future directions

In addition, to overcome the above mentioned limitations in future studies, this dissertation leaves open questions and new challenges that will be presented in the next paragraphs.

First, it is important to replicate the findings in different samples or make small modifications in the experiments, in order to disentangle *what posture* is adequate for *what mental disorder*, at *what moment,* and to change *what specific outcome*. For instance, Davis et al. (2017) did not find significant benefits of an expansive posture, compared to the natural or stooped posture, in three sessions of exposure, in the ratings of fear or the hormonal levels of testosterone and cortisol in individuals with fear of public speaking. However, it left some questions unanswered that study 1 of this dissertation attempted to answer (e.g., exploring the specific therapeutic outcomes modified by the posture).

Second, it would be interesting to test whether it is necessary to manipulate the expansiveness or the body (as in studies 1 and 2), or whether it is enough to manipulate the back, neck, and shoulders of the individuals (as in study 3) to achieve specific outcomes. In the literature, they have been analyzed jointly (Cuddy, Schultz, & Fosse, 2018), assuming that there are no significant differences between them. However, we would propose comparing the common postures adopted in embodied cognition studies in order to figure out whether these postures are equivalent, or one is superior to the

others, by comparing those that emphasize the expansiveness of the body (e.g., Carney et al., 2010) to those that emphasize the erectness of the body (Michalak et al., 2014).

Third, it would be interesting to test whether adopting a posture after receiving a short psychoeducation about the expected effects would have a greater effect on the emotional and cognitive processes than adopting a posture without knowing the expected effects of the posture. This study would give us valuable information about whether it is feasible to include body-related strategies as part of the therapy.

Fourth, it could be interesting to explore how the manipulation of the body can be included in the daily lives of the patients. In this regard, using devices with postural sensors connected to mobile applications, which provide feedback to the patients about their posture during the day, could be a useful strategy. For instance, by sending reminders to patients diagnosed with depression throughout the day (e.g., *"Stand up straight! It helps you to feel better"*). Moreover, this kind of study could allow us to test more long-term effects of the embodied cognition effects.

Fifth, in order to transfer the findings from the laboratory to the clinical setting, it would be interesting to start to conduct experimental single-case designs (Roth & Fonagy, 2013) where the focus is on the individual rather than a group average. Although their results are difficult to generalize to the broader population, these designs are of great importance in treatment innovation to bridge the gap between research and clinical practice.

Finally, it is highly necessary to continue to study the mechanisms underlying the embodied cognition effects. Only a comprehensive theoretical framework will allow us to perform effective therapeutic interventions, and only controlled studies will provide appropriate responses.

5. Conclusions

The main findings regarding the general objectives of this dissertation are presented in the following points:

- Adopting expansive and upright (vs. contractive and stooped) postures for a short period of time, before an anxiety-provoking situation (associated with fear of public speaking and body dissatisfaction), seems to have positive effects on emotional and cognitive processes in women.
- Adopting an upright (vs. stooped) posture seems to interact with mechanisms involved in the maintenance of depression (cognitive bias interpretation and vividness of positive imagery), as well as emotions that tend to be low in depression (happiness, optimism, and vigor) in a non-clinical sample, but with a broad range of depressive symptomatology.
- The level of the symptomatology seems to have great importance in moderating the embodied effects of posture on emotional and cognitive outcomes: the higher the level of the symptomatology of fear of public speaking and depression, the greater the changes in emotional and cognitive processes derived from the body manipulation.
- The underlying mechanism through which the posture can influence emotional and cognitive processes may be related to a direct state induction, in which more positive affective responses (e.g., positive emotions) and non-affective responses (e.g., reducing negative cognitive bias) are induced.
- Manipulating the posture before the exposure technique could serve as a strategy to overcome a stressful situation, inducing a cognitive or emotional state of being more prepared or empowered. Moreover, manipulating the posture could be used as a strategy of emotion regulation for improving depression-related emotions or

modulating negative cognitive processes (interpretation bias and imagery) in a non-stressful task. Nevertheless, this conclusion is a first attempt to clarify the possible clinical implications, as the studies derived from this dissertation do not allow us to make strong affirmations in this regard.

- The embodied effects of posture need to be deeply analyzed, and only research will help to disentangle how, when, for whom, and why adopting a specific posture could be beneficial in clinical therapy as a strategy along with the current evidence-based therapies.

6. References

Blackwell, S. E., Browning, M., Mathews, A., Pictet, A., Welch, J., Davies, J., ... & Holmes, E. A. (2015). Positive imagery-based cognitive bias modification as a web-based treatment tool for depressed adults: a randomized controlled trial. *Clinical Psychological Science*, *3*(1), 91-111. doi: 10.1177/2167702614560746

Blackwell, S. E., & Holmes, E. A. (2010). Modifying interpretation and imagination in clinical depression: A single case series using cognitive bias modification. *Applied Cognitive Psychology*, *24*(3), 338-350. doi: 10.1002/acp.1680

Carney, D. R., Cuddy, A. J. C., & Yap, A. J. (2010). Power Posing: Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance. *Psychological Science*, *21*(10), 1363–1368. doi:10.1177/0956797610383437

Carney, D. R., Cuddy, A. J. C., & Yap, A. J. (2015). Review and Summary of Research on the Embodied Effects of Expansive (vs. Contractive) Nonverbal Displays. *Psychological Science*, *26*(5), 657–663. doi:10.1177/0956797614566855

Clarke, P. J., Nanthakumar, S., Notebaert, L., Holmes, E. A., Blackwell, S. E., & MacLeod, C. (2014). Simply imagining sunshine, lollipops and rainbows will not budge the bias: The role of ambiguity in interpretive bias modification. *Cognitive therapy and research*, *38*(2), 120-131. doi: 10.1007/s10608-013-9564-x

Cuddy, A. J. C., Schultz, S. J., & Fosse, N. E. (2018). P-Curving a More Comprehensive Body of Research on Postural Feedback Reveals Clear Evidential Value For Power-Posing Effects: Reply to Simmons and Simonsohn (2017). *Psychological Science*, 29(4), 656-666. doi: 10.1177/0956797617746749

Cuddy, A. J. C., Wilmuth, C. A., Yap, A. J., & Carney, D. R. (2015). Preparatory power posing affects nonverbal presence and job interview performance. *Journal of Applied Psychology*, *100*(4), 1286–1295. doi:10.1037/a0038543

Davis, M. L., Papini, S., Rosenfield, D., Roelofs, K., Kolb, S., Powers, M. B., & Smits, J. A. J. (2017). A randomized controlled study of power posing before public speaking exposure for social anxiety disorder: No evidence for augmentative effects. *Journal of Anxiety Disorders, 52*(Dec), 1–7. doi: 10.1016/j.janxdis.2017.09.004

de Zavala, A. G., Lantos, D., & Bowden, D. (2017). Yoga poses increase subjective energy and state self-esteem in comparison to "power poses." *Frontiers in Psychology, 8*(752), 1–12. doi: 10.3389/fpsyg.2017.00752

Gilbert, P. (2001). Evolution and social anxiety: The role of attraction, social competition, and social hierarchies. *Psychiatric Clinics, 24*(4), 723-751. doi: 10.1016/S0193-953X(05)70260-4

Koole, S. L., & Veenstra, L. (2015). Does Emotion Regulation Occur Only Inside People's Heads? Toward a Situated Cognition Analysis of Emotion-Regulatory Dynamics. *Psychological Inquiry*, *26*(1), 61–68. doi:10.1080/1047840X.2015.964657

Körner, A., Topolinski, S., & Strack, F. (2015). Routes to embodiment. *Frontiers in Psychology, 6*(940), 1–10. doi: 10.3389/fpsyg.2015.00940

Kozak, M. N., Roberts, T. A., & Patterson, K. E. (2014). She stoops to conquer? How posture interacts with self-objectification and status to impact women's affect and performance. *Psychology of Women Quarterly*, *38*(3), 414–424. doi:10.1177/0361684313517865

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology*, *84*(3), 394–421. doi:10.1016/j.biopsycho.2010.03.010

Laird, J. D., & Lacasse, K. (2014). Bodily influences on emotional feelings: Accumulating evidence and extensions of William James's theory of emotion. Emotion Review, 6(1), 27-34. doi: 10.1177/1754073913494899

Lang, T. J., Blackwell, S. E., Harmer, C. J., Davison, P., & Holmes, E. A. (2012). Cognitive bias modification using mental imagery for depression: developing a novel computerized intervention to change negative thinking styles. *European Journal of Personality*, *26*(2), 145-157. doi: 10.1002/per.855

Michalak, J., Mischnat, J., & Teismann, T. (2014). Sitting posture makes a difference-embodiment effects on depressive memory bias. *Clinical Psychology and Psychotherapy*, *21*(6), 519–524. doi:10.1002/cpp.1890

Michalak, J., Rohde, K., & Troje, N. F. (2015). How we walk affects what we remember: Gait modifications through biofeedback change negative affective memory bias. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 121–125. doi:10.1016/j.jbtep.2014.09.004

Michalak, J., Troje, N. F., Fischer, J., Vollmar, P., Heidenreich, T., & Schulte, D. (2009). Embodiment of sadness and depression-gait patterns associated with dysphoric mood. *Psychosomatic Medicine*, *71*(5), 580–587. doi:10.1097/PSY.0b013e3181a2515c

Nair, S., Sagar, M., Sollers, J., Consedine, N., & Broadbent, E. (2015). Do slumped and upright postures affect stress responses? A randomized trial. *Health Psychology*, *34*(6), 632–641. doi:10.1037/hea0000146

Roberts, T. A., & Arefi-Afshar, Y. (2007). Not all who stand tall are proud: Gender differences in the proprioceptive effects of upright posture. *Cognition and Emotion*, *21*(4), 714–727. doi:10.1080/02699930600826432

Roth, A., & Fonagy, P. (2013). *What works for whom?: a critical review of psychotherapy research.* New York, NY: Guilford Publications.

Veenstra, L., Schneider, I. K., & Koole, S. L. (2016). Embodied mood regulation: the impact of body posture on mood recovery, negative thoughts, and mood-congruent recall. *Cognition and Emotion*, *31*(7), 1361–1376. doi:10.1080/02699931.2016.1225003

Weisfeld, G. E., & Beresford, J. M. (1982). Erectness of posture as an indicator of dominance or success in humans. *Motivation and Emotion, 6*(2), 113-131.

Wilkes, C., Kydd, R., Sagar, M., & Broadbent, E. (2017). Upright posture improves affect and fatigue in people with depressive symptoms. *Journal of Behavior Therapy and Experimental Psychiatry*, *54*, 143–149. doi:10.1016/j.jbtep.2016.07.015

Wilson, V. E., & Peper, E. (2004). The effects of upright and slumped postures on the recall of positive and negative thoughts. *Applied Psychophysiology Biofeedback*, *29*(3), 189–195. doi:10.1023/B:APBI.0000039057.32963.34

Zhang, X., Yu, H. W., & Barrett, L. F. (2014). How does this make you feel? A comparison of four affect induction procedures. *Frontiers in Psychology*, *5*(689), 1–10. doi: 10.3389/fpsyg.2014.00689

ANNEXES

1. Annex 1: Annexes of Study 1

Annex 1a. Ethics committee approval

VNIVERSITAT DE VALÈNCIA Vicerectorat d'Investigació i Política Científica

D. Fernando A. Verdú Pascual, Profesor Titular de Medicina Legal y Forense, y Secretario del Comité Ético de Investigación en Humanos de la Comisión de Ética en Investigación Experimental de la Universitat de València,

CERTIFICA:

Que el Comité Ético de Investigación en Humanos, en la reunión celebrada el día 22 de septiembre de 2014, una vez estudiado el proyecto de tesis doctoral titulado:
"El papel de la postura corporal en el miedo a hablar en público", número de procedimiento H1406534160750,
cuya doctoranda es Dña. Marta Miragall Montilla,
ha acordado informar favorablemente el mismo dado que se respetan los principios fundamentales establecidos en la Declaración de Helsinki, en el Convenio del Consejo de Europa relativo a los derechos humanos y cumple los requisitos establecidos en la legislación española en el ámbito de la investigación biomédica, la protección de datos de carácter personal y la bioética.

Y para que conste, se firma el presente certificado en Valencia, a veintitrés de septiembre de dos mil catorce.

FERNANDO ALEJO|
VERDU|PASCUAL
2014.09.24
10:21:29 +02'00'

Av. Blasco Ibáñez, 13 tel: 9638 64109 vicerec.investigacio@uv.es
València 46010 fax: 9639 83221 www.uv.es/senmves

Annex 1b. Informed consent

HOJA DE CONSENTIMIENTO INFORMADO

El estudio en el que vas a participar tiene como objetivo analizar cómo la relajación de los músculos del cuerpo influye en los cambios hormonales relacionados con el cortisol ante la realización de una tarea de laboratorio. Tu participación consistirá en rellenar algunos cuestionarios, proporcionarnos dos muestras de tu cortisol (a través del pase de un algodón por tu boca) y la realización de una tarea. Esta tarea será grabada en una cámara de vídeo. El pase experimental tendrá una duración aproximada de 25 minutos. Al final de la prueba te recompensaremos con 5 euros por tu participación.

Yo, _____, MANIFIESTO:

1. Que he sido informado de las pruebas que realizaré como consecuencia de la investigación que se está llevando a cabo.

2. Que estoy de acuerdo y acepto, libre y voluntariamente participar y cumplimentar los cuestionarios que se me indiquen.

3. Que, salvaguardado siempre mi derecho a la intimidad y al anonimato, acepto que los datos que se deriven de mi participación puedan ser utilizados para la divulgación científica. Así pues, todos los datos serán tratados de forma confidencial, siguiendo para ello las medidas y niveles de seguridad de protección de los datos personales exigidos por la Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal y su normativa de desarrollo, y sólo serán utilizados con fines de investigación.

4. Que, consiento expresamente el tratamiento de mis datos personales que se incorporarán al fichero de investigación de la Universitat de València y serán objeto de tratamiento para las finalidades de investigación, estudio y publicación propias de este estudio de acuerdo con los siguientes criterios:

a) Podrán incorporarse tanto los datos de identificación, como los obtenidos a partir de grabaciones de imagen y sonido, obtención de muestras o respuestas a cuestionarios.

b) Los datos obtenidos en la investigación podrán ser objeto de publicación y otras actividades de investigación en forma anónima.

Puede ejercer los derechos de acceso, rectificación, cancelación u oposición al tratamiento mediante escrito dirigido a “Protección de datos, Servei d’Informàtica, C/ Amadeo de Saboya 4, 46010 Valencia. Al escrito deberá acompañarse indicación del derecho que se ejerce, copia de un documento oficial que acredite su identidad, así como la documentación que en su caso justifique la petición.

5. Que, salvaguardando siempre mi derecho a la intimidad y al anonimato, estoy de acuerdo y acepto libre y voluntariamente la grabación en vídeo/audio.

6. Que, salvaguardando siempre mi derecho a la intimidad y al anonimato, estoy de acuerdo y acepto libre y voluntariamente la extracción de mi muestra de saliva, que será procesada bajo todos los controles de calidad que la normativa obliga a aplicar y sus datos, debidamente desvinculados de mi identidad. Las muestras de saliva serán almacenadas con el mismo rigor de custodia que las muestras de origen judicial.

7. Que, a pesar de haber autorizado lo dicho en el punto anterior, puedo cambiar de opinión respecto a la utilización de esos datos, en cualquier momento del proceso y puedo retirarme del estudio cuando quiera y puede solicitar que sus resultados sean retirados de la base de datos.

8. La información respecto a este consentimiento me ha sido dada de forma comprensible, por lo que tomo libremente la decisión de autorizar para proceder a la obtención de los datos que para este proyecto sean necesarios.

Firma del participante:

Appendix 1c. Questionnaires constructed by the authors used in study 1 (Spanish and English versions)

The questionnaires used in this study that have been published previously are cited in the methods section. However, the questionnaires constructed by the authors are included below:

Negative Emotions' scale (ES) – English version

Next, you will find different words that express an emotion. You should indicate to what extent you feel each one of these emotions RIGHT NOW, taking into account the following scale:

	Not at all	**Very little**	**A little**	**Some**	**Quite**	**A lot**	**Completely**
Anxiety	1	2	3	4	5	6	7
Non-dominance/ Non- Control of the situation	1	2	3	4	5	6	7
Desire to avoid the situation	1	2	3	4	5	6	7

Escala de emociones negativas (ES) – Spanish version

A continuación, encontrarás una serie de palabras que expresan una emoción. Indica en qué medida sientes cada una de estas emociones en ESTE MOMENTO, teniendo en cuenta la siguiente escala:

	Nada en absoluto	**Muy poco**	**Poco**	**Algo**	**Bastante**	**Mucho**	**Totalmente**
Ansiedad	1	2	3	4	5	6	7
Falta de dominio/Falta de control de la situación	1	2	3	4	5	6	7
Deseo de evitar la situación	1	2	3	4	5	6	7

Perceived Performance Scale (PPS)– English version

Please, answer the following questions:

1. In general, how good do you think your performance will be during the speech?

Not valid	Poor	Very poor	Not very good	Good	Very good	Excellent
1	2	3	4	5	6	7

2. In general, how good do you think your performance was during the speech?

Not valid	Poor	Very poor	Not very good	Good	Very good	Excellent
1	2	3	4	5	6	7

Perceived Performance Scale (PPS)– Spanish version

Por favor, responde a las siguientes preguntas:

1. En general, ¿cómo crees que será tu actuación durante el discurso?

Nula	Muy pobre	Pobre	Regular	Buena	Muy buena	Excelente
1	2	3	4	5	6	7

2. En general, ¿cómo crees que ha sido tu actuación en la tarea?

Nula	Muy pobre	Pobre	Regular	Buena	Muy buena	Excelente
1	2	3	4	5	6	7

2. Annex 2: Annexes of Study 2

Appendix 2a. Ethics committee approval

VNIVERSITAT DE VALÈNCIA Vicerectorat d'Investigació i Política Científica

D. José María Montiel Company, Profesor Contratado Doctor Interino del departamento de Estomatología, y Secretario del Comité Ético de Investigación en Humanos de la Comisión de Ética en Investigación Experimental de la Universitat de València,

CERTIFICA:

Que el Comité Ético de Investigación en Humanos, en la reunión celebrada el día 12 de diciembre de 2016, una vez estudiado el proyecto de investigación titulado:
"El papel de la postura corporal en la exposición al cuerpo en personas con insatisfacción corporal", número de procedimiento H1477391858939,
cuya responsable es Dña. Rosa Mª Baños Rivera,
ha acordado informar favorablemente el mismo dado que se respetan los principios fundamentales establecidos en la Declaración de Helsinki, en el Convenio del Consejo de Europa relativo a los derechos humanos y cumple los requisitos establecidos en la legislación española en el ámbito de la investigación biomédica, la protección de datos de carácter personal y la bioética.

Y para que conste, se firma el presente certificado en Valencia, a catorce de diciembre de dos mil dieciséis.

Av. Blasco Ibáñez, 13 tel: 9638 64109 vicerec.investigacio@uv.es
València 46010 fax: 9639 83221 www.uv.es/seninves

Appendix 2b. Informed consent

HOJA DE CONSENTIMIENTO INFORMADO

1.- INFORMACIÓN AL PARTICIPANTE

Ha mostrado interés en participar en el estudio **"Sensorización corporal e imagen corporal",** desarrollado por la Universidad de Valencia. A continuación le pediremos que nos proporcione su consentimiento, de forma escrita, para participar en este estudio. Por favor, lea el siguiente texto con detenimiento y no dude en hacer cualquier pregunta.

La información básica que debe conocer es la siguiente:

a) Los resultados de este proyecto de investigación pueden contribuir a la mayor comprensión de los procesos corporales. El estudio ayudará a validar sensores de movimiento corporal. Asimismo, la tarea que realizará y los cuestionarios que rellenará nos ayudarán a entender en mayor medida los procesos relacionados con la imagen corporal.
b) De acuerdo con el conocimiento existente, el protocolo de evaluación e intervención psicológica utilizados en este estudio no implica un riesgo para su salud.
c) Percibirá una compensación económica de 5 euros por participar en esta investigación. La información no será vendida o distribuida a terceros con fines comerciales.
d) La participación en este proyecto de investigación es voluntaria y puede cancelarse en cualquier momento. Si rechaza participar, no habrá consecuencias negativas para usted. Si se retira del proyecto, puede decidir si los datos utilizados hasta ese momento, deben borrarse o si se pueden seguir utilizando tras haberlos convertido en anónimos (p. ej., eliminando los datos de la información identificativa, incluido el código, para que resulte imposible volver a identificarlos). Pueden solicitar a los investigadores que les proporcionen los datos almacenados en el registro y que corrijan los errores en ellos en cualquier momento.
e) Los datos que se deriven de la participación pueden ser utilizados con fines de investigación, estudio y publicación, salvaguardado siempre el derecho a la intimidad y el anonimato.
f) El proyecto se realizará siguiendo los criterios éticos internacionales recogidos en la Declaración de Helsinki.

Si necesita cualquier aclaración, contacte con la investigadora principal del proyecto, Rosa Mª Baños Rivera, en el teléfono 96 386 44 12 o en la dirección de correo electrónico banos@uv.es.

2. COMPROMISO DE CONFIDENCIALIDAD. Los datos serán tratados de forma confidencial, siguiendo para ello las medidas y niveles de seguridad de protección de los datos personales exigidos por la Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal y su normativa de desarrollo.

3.CONSENTIMIENTO.

Don/Doña _____,
mayor de edad, titular del DNI: _____, por el presente documento manifiesto que:

He sido informado/a de las características del Proyecto de Investigación titulado: **"Sensorización corporal e imagen corporal".**

He leído tanto el apartado 1 del presente documento titulado "información al participante", como el apartado 2 titulado "compromiso de confidencialidad", y he podido formular las dudas que me han surgido al respecto. Considero que he entendido dicha información.

Estoy informado/a de la posibilidad de retirarme en cualquier momento del estudio.

En virtud de tales condiciones, consiento participar en este estudio.

Y en prueba de conformidad, firmo el presente documento en el lugar y fecha que se indican a continuación.

_____, _____ de _____ de 20___.

Nombre y apellidos *del / de la participante*: Firma:	*Nombre y apellidos* *del investigador responsable*: Firma:

REVOCACIÓN DEL CONSENTIMIENTO

Revoco el consentimiento prestado en fecha _____ para participar en el proyecto titulado **"Sensorización corporal e imagen corporal"** y, para que así conste, firmo la presente revocación.

_____, _____ de _____ de 20___.

Nombre y apellidos del / de la participante: Firma:	*Nombre y apellidos del investigador responsable*: Firma:

Appendix 2c. Questionnaires constructed by the authors used in study 2 (Spanish and English versions).

The questionnaires used in this study that have been published previously are cited in the methods section of this study. However, the questionnaires constructed by the authors are included below:

Emotions' scale (ES) – English version

Next, you will find different words that express an emotion. You should indicate to what extent you feel each one of these emotions RIGHT NOW, taking into account the following scale:

	Not at all	Very little	A little	Some	Quite	A lot	Completely
Self-confidence	1	2	3	4	5	6	7
Insecurity	1	2	3	4	5	6	7
Anxiety	1	2	3	4	5	6	7
Anger	1	2	3	4	5	6	7
Disgust	1	2	3	4	5	6	7
Shame	1	2	3	4	5	6	7
Happiness	1	2	3	4	5	6	7
Sadness	1	2	3	4	5	6	7

Escala de emociones (ES) – Spanish version

A continuación, encontrarás una serie de palabras que expresan una emoción. Indica en qué medida sientes cada una de estas emociones en ESTE MOMENTO, teniendo en cuenta la siguiente escala:

	Nada en absoluto	Muy poco	Poco	Algo	Bastante	Mucho	Totalmente
Autoconfianza	1	2	3	4	5	6	7
Inseguridad	1	2	3	4	5	6	7
Ansiedad	1	2	3	4	5	6	7
Enfado	1	2	3	4	5	6	7
Repulsión	1	2	3	4	5	6	7
Vergüenza	1	2	3	4	5	6	7
Felicidad	1	2	3	4	5	6	7
Tristeza	1	2	3	4	5	6	7

Scale of appraisal of the body descriptions – English version

In this questionnaire you will have to appraise the two comments you have made of each part of your body as “negative”, “neutral” or “positive”. You should rate it as you consider. There are no right or wrong answers.

	Negative					**Neutral**					**Positive**
1a. For me, that my hair is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
1b. For me, that my hair is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
2a. For me, that my skin is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
2b. For me, that my skin is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
3a. For me, that my eyes are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
3b. For me, that my eyes are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
4a. For me, that my nose is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
4b. For me, that my nose is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
5a. For me, that my mouth is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
5a. For me, that my mouth is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
6a. For me, that my neck is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
6b. For me, that my neck is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
7a. For me, that my arms are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
7b. For me, that my arms are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
8a. For me, that my chest is…	-5	-4	-3	-2	-1	0	1	2	3	4	5

8b. For me, that my <u>chest</u> is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
9a. For me, that my <u>waist</u> is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
9b. For me, that my <u>waist</u> is…	-5	-4	-3	-2	-1	0	1	2	3	4	5
10a. For me, that my <u>hips</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
10b. For me, that my <u>hips</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
11a. For me, that my <u>buttocks</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
11b. For me, that my <u>buttocks</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
12a. For me, that my <u>thighs</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
12b. For me, that my <u>thighs</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
13a. For me, that my <u>knees</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
13b. For me, that my <u>knees</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
14a. For me, that my <u>calves</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
14b. For me, that my <u>calves</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
15a. For me, that my <u>feet</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5
15b. For me, that my <u>feet</u> are…	-5	-4	-3	-2	-1	0	1	2	3	4	5

Escala de valoración de las descripciones del cuerpo– Spanish version

En este cuestionario tendrás que valorar los dos comentarios que has realizado de cada parte de tu cuerpo como “negativo”, “neutro” o “positivo”. Tienes que puntuarlo tal y como tú lo consideras. No hay respuestas buenas ni malas.

	Negativo					**Neutro**					**Positivo**
1a. Para mí, que mi pelo sea…	-5	-4	-3	-2	-1	0	1	2	3	4	5
1b. Para mí, que mi pelo sea…	-5	-4	-3	-2	-1	0	1	2	3	4	5
2a. Para mí, que mi piel sea…	-5	-4	-3	-2	-1	0	1	2	3	4	5
2b. Para mí, que mi piel sea…	-5	-4	-3	-2	-1	0	1	2	3	4	5
3a. Para mí, que mis ojos sean…	-5	-4	-3	-2	-1	0	1	2	3	4	5
3b. Para mí, que mis ojos sean…	-5	-4	-3	-2	-1	0	1	2	3	4	5
4a. Para mí, que mi nariz sea…	-5	-4	-3	-2	-1	0	1	2	3	4	5
4b. Para mí, que mi nariz sea…	-5	-4	-3	-2	-1	0	1	2	3	4	5
5a. Para mí, que mi boca sea…	-5	-4	-3	-2	-1	0	1	2	3	4	5
5a. Para mí, que mi boca sea...	-5	-4	-3	-2	-1	0	1	2	3	4	5
6a. Para mí, que mi cuello sea...	-5	-4	-3	-2	-1	0	1	2	3	4	5
6b. Para mí, que mi cuello sea...	-5	-4	-3	-2	-1	0	1	2	3	4	5
7a. Para mí, que mis brazos sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
7b. Para mí, que mis brazos sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
8a. Para mí, que mi pecho sea...	-5	-4	-3	-2	-1	0	1	2	3	4	5
8b. Para mí, que mi pecho sea...	-5	-4	-3	-2	-1	0	1	2	3	4	5

9a. Para mí, que mi <u>cintura</u> sea...	-5	-4	-3	-2	-1	0	1	2	3	4	5
9b. Para mí, que mi <u>cintura</u> sea...	-5	-4	-3	-2	-1	0	1	2	3	4	5
10a. Para mí, que mis <u>caderas</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
10b. Para mí, que mis <u>caderas</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
11a. Para mí, que mis <u>glúteos</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
11b. Para mí, que mis <u>glúteos</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
12a. Para mí, que mis <u>muslos</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
12b. Para mí, que mis <u>muslos</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
13a. Para mí, que mis <u>rodillas</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
13b. Para mí, que mis <u>rodillas</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
14a. Para mí, que mis <u>pantorrillas</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
14b. Para mí, que mis <u>pantorrillas</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
15a. Para mí, que mis <u>pies</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5
15b. Para mí, que mis <u>pies</u> sean...	-5	-4	-3	-2	-1	0	1	2	3	4	5

3. Annex 3: Annexes of Study 3

Annex 3a. Ethics committee approval

VNIVERSITAT DE VALÈNCIA Vicerectorat d'Investigació i Política Científica

D. José María Montiel Company, Profesor Contratado Doctor Interino del departamento de Estomatología, y Secretario del Comité Ético de Investigación en Humanos de la Comisión de Ética en Investigación Experimental de la Universitat de València,

CERTIFICA:

Que el Comité Ético de Investigación en Humanos, en la reunión celebrada el día 2 de marzo de 2017, una vez estudiado el proyecto de investigación titulado:
"Effect olf an upright (vs. Slumped) body postureo n cognitive bias", número de procedimiento H1488208601380,
cuya responsable es Dña. Rosa Mª Baños Rivera,
ha acordado informar favorablemente el mismo dado que se respetan los principios fundamentales establecidos en la Declaración de Helsinki, en el Convenio del Consejo de Europa relativo a los derechos humanos y cumple los requisitos establecidos en la legislación española en el ámbito de la investigación biomédica, la protección de datos de carácter personal y la bioética.

Y para que conste, se firma el presente certificado en Valencia, a tres de marzo de dos mil diecisiete.

UNIVERSITAT DE VALÈNCIA

Av. Blasco Ibáñez, 13 tel: 9638 64109 vicerec.investigacio@uv.es
València 46010 fax: 9639 83221 www.uv.es/serinves

Annex 3b. Informed consent

HOJA DE CONSENTIMIENTO INFORMADO

1.- INFORMACIÓN AL PARTICIPANTE

Ha mostrado interés en participar en un estudio **"Sesgos cognitivos y validación de sensores corporales",** desarrollado por la Universidad de Valencia. A continuación, le pediremos que nos proporcione su consentimiento, de forma escrita, para participar en este estudio. Por favor, lea el siguiente texto con detenimiento y no dude en hacer cualquier pregunta.

La información básica que debe conocer es la siguiente:

a) Los resultados de este proyecto de investigación pueden contribuir a la mayor comprensión de los procesos que contribuyen a mejorar el bienestar psicológico. El estudio también ayudará a validar sensores corporales.
b) De acuerdo con el conocimiento existente, el protocolo de evaluación e intervención psicológica utilizados en este estudio no implica un riesgo para su salud.
c) Percibirá 10 € por su participación en el estudio. La información no será vendida o distribuida a terceros con fines comerciales.

d) La participación en este proyecto de investigación es voluntaria y puede cancelarse en cualquier momento. Si rechaza participar, no habrá consecuencias negativas para usted. Si se retira del proyecto, puede decidir si los datos utilizados hasta ese momento, deben borrarse o si se pueden seguir utilizando tras haberlos convertido en anónimos (p. ej., eliminando los datos de la información identificativa, incluido el código, para que resulte imposible volver a identificarlos). Pueden solicitar a los investigadores que les proporcionen los datos almacenados en el registro y que corrijan los errores en ellos en cualquier momento.
e) Los datos que se deriven de la participación pueden ser utilizados con fines de investigación, estudio y publicación, salvaguardado siempre el derecho a la intimidad y el anonimato.
f) El proyecto se realizará siguiendo los criterios éticos internacionales recogidos en la Declaración de Helsinki.

Si necesita cualquier aclaración, contacte con la investigadora principal del proyecto, Rosa Mª Baños Rivera, en el teléfono 96 386 44 12 o en la dirección de correo electrónico banos@uv.es.

2. COMPROMISO DE CONFIDENCIALIDAD. Los datos serán tratados de forma confidencial, siguiendo para ello las medidas y niveles de seguridad de protección de los datos personales exigidos por la Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal y su normativa de desarrollo.

3.CONSENTIMIENTO.

Don/Doña _____,
mayor de edad, titular del DNI: _____, por el presente documento manifiesto que:

He sido informado/a de las características del Proyecto de Investigación titulado: **"Sesgos cognitivos y validación de sensores corporales".**
He leído tanto el apartado 1 del presente documento titulado "información al participante", como el apartado 2 titulado "compromiso de confidencialidad", y he podido formular las dudas que me han surgido al respecto. Considero que he entendido dicha información.

Estoy informado/a de la posibilidad de retirarme en cualquier momento del estudio.

En virtud de tales condiciones, consiento participar en este estudio.
Y en prueba de conformidad, firmo el presente documento en el lugar y fecha que se indican a continuación.
_____, _____ de _____ de 20___.

Nombre y apellidos del / de la participante: Firma:	*Nombre y apellidos del investigador responsable*: Firma:

REVOCACIÓN DEL CONSENTIMIENTO
Revoco el consentimiento prestado en fecha _____ para participar en el proyecto titulado **"Sesgos cognitivos y validación de sensores corporales"** y, para que así conste, firmo la presente revocación.
_____, _____ de _____ de 20___.

Nombre y apellidos del / de la participante: Firma:	*Nombre y apellidos del investigador responsable*: Firma:

Appendix 3c. Questionnaires constructed by the authors used in study 3 (Spanish and English versions).

The questionnaires used in this study that have been published previously are cited in the methods section. However, the questionnaires constructed by the authors are included below:

Emotions' scale (ES) – English version

Next, you will find different words that express an emotion. You should indicate to what extent you feel each one of these emotions RIGHT NOW/THE LAST MINUTES, taking into account the following scale:

	Not at all	A little	Moderately	Quite	Extremely
Happy	1	2	3	4	5
Sad	1	2	3	4	5
Optimistic	1	2	3	4	5
Hopeless	1	2	3	4	5
Anxious	1	2	3	4	5
Relaxed	1	2	3	4	5

Escala de emociones (ES) – Spanish version

A continuación, encontrarás una serie de palabras que expresan una emoción. Indica en qué medida sientes cada una de estas emociones en ESTE MOMENTO/EN LOS ÚLTIMOS MINUTOS, teniendo en cuenta la siguiente escala:

	En absoluto	Un poco	Moderadamente	Bastante	Muchísimo
Feliz	1	2	3	4	5
Triste	1	2	3	4	5
Optimista	1	2	3	4	5
Desesperanzado/a	1	2	3	4	5
Ansioso/a	1	2	3	4	5
Calmado/a	1	2	3	4	5