Rehabilitación de la Cognición Social tras Daño Cerebral Adquirido en niños/as y adultos

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A mis padres, por ser un apoyo constante y ejemplo de perseverancia.
Gracias por enseñarme que con trabajo y esfuerzo puedo lograr los objetivos que me proponga.

En aplicación de la Ley 3/2007, de 22 de marzo, para la igualdad efectiva de mujeres y hombres, así como de la Ley 12/2007, de 26 de noviembre, para la Promoción de Igualdad de Género en Andalucía, toda alusión a personas o colectivos incluida en este documento hará referencia al género gramatical no marcado. Esto implica la capacidad de referirse tanto a niños como a niñas, hombres o mujeres, así como a colectivos que no se identifiquen plenamente con ambos géneros. Esta elección no pretende excluir ni invisibilizar a ninguna identidad de género, sino facilitar la fluidez del texto.

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Resumen

La Cognición Social (CS) es la capacidad que permite comprender, interpretar y responder de manera apropiada a las señales sociales presentes en el entorno y en las interacciones con otras personas (Spikman et al., 2012). La CS engloba procesos mentales complejos que posibilitan el aprender y entender las intenciones, emociones, creencias y pensamientos tanto propios como ajenos. La CS abarca la capacidad de generar respuestas sociales adecuadas, como la interpretación de gestos y expresiones faciales, y la adaptación del comportamiento según el contexto social y las expectativas de los demás (Adolphs, 2010). En definitiva, la CS se erige como un componente esencial para lograr una integración social efectiva, ya que posibilita que la persona pueda desenvolverse satisfactoriamente en el entorno social (McDonald & Genova, 2021).

Cuando la CS no se desarrolla adecuadamente o se ve afectada, pueden surgir dificultades caracterizadas por la incapacidad para interpretar con precisión emociones propias y ajenas, comprender y utilizar señales sociales, discernir las intenciones de otros y ajustar el comportamiento según las demandas sociales (Smith & Semin, 2007). Estas limitaciones impactan en la formación y mantenimiento de amistades y relaciones significativas, lo que puede llevar a la exclusión social parcial o total (Spikman et al., 2012).

En muchas ocasiones, las personas que han experimentado un daño cerebral adquirido (DCA) presentan un deterioro en la CS. Wallis et al. (2022) reveló que al menos uno de los componentes de la CS muestra alteraciones en el 83.11 % de los casos examinados en individuos con DCA. A pesar de este resultado, son escasos los instrumentos que permiten evaluar los componentes de la CS, por lo que la mayoría de los programas de rehabilitación solamente se limitan al tratamiento de algunos de ellos, como el procesamiento emocional y la Teoría de la Mente (ToM) (Roelofs et al., 2017).

El objetivo general de esta Tesis Doctoral consiste en aportar herramientas y evidencias de su utilidad para el abordaje de la CS en niños, adolescentes y adultos con DCA.

Esta Tesis Doctoral se estructura en nueve capítulos distribuidos en cuatro secciones. La primera sección abarca la Introducción y comprende los Capítulos 1 al 3. En el Capítulo 1 se introduce el concepto de CS y se describen las características de sus componentes principales: procesamiento emocional, conocimiento social, ToM y empatía. Además, se examinan los diversos modelos explicativos de la CS. En el Capítulo 2 se presenta una revisión de los distintos instrumentos disponibles para evaluar la CS y sus componentes, haciendo especial mención a aquellos diseñados para individuos con DCA. En el Capítulo 3 se revisan los diferentes programas de rehabilitación que se centran en uno o varios componentes de la CS. Al igual que en el capítulo anterior, se especifican los programas diseñados para personas con DCA.

La segunda sección de esta Tesis Doctoral, donde se incluye el Capítulo 4, se centra en la presentación y justificación de las hipótesis y los objetivos de la Tesis Doctoral, indicando la relevancia de la investigación desarrollada.

La tercera sección se corresponde con la Memoria de Trabajos y está formada por los Capítulos del 5 al 7. En ellos se recoge la parte empírica de esta Tesis Doctoral a través de los tres estudios llevados a cabo. En el Capítulo 5 se presenta el primer estudio que tuvo como objetivo determinar las propiedades psicométricas de la escala de evaluación de la ToM en niños: ToMas-child (Rivas-Garcia et al., 2020). Para ello, doscientos cincuenta y dos niños españoles de 3 a 7 años fueron evaluados en entornos escolares. Empleando un análisis de Rasch, se determinó que la ToMas-child es una escala unidimensional válida para la evaluación de los principales componentes de la ToM en niños.

En el Capítulo 6 se presenta el segundo estudio que tuvo como objetivo determinar la efectividad de utilizar la metodología de diseño de caso único en tres intervenciones, cada una dirigida a mejorar un comportamiento alterado por los déficits en la CS. Estos comportamientos fueron: (1) expresión de emociones positivas, (2) reacción a cambios en los planes y (3) saludo a los compañeros de clase. En el desarrollo se utilizó el diseño de metodología de caso único A-B-A' donde cada comportamiento fue abordado con un programa de rehabilitación específico aplicado durante 10 sesiones. Los resultados mostraron que, en relación al primer comportamiento (1), los cambios entre las fases B-A' y A-A' indicaron mejoras en la capacidad del niño para expresar emociones positivas. En el segundo comportamiento (2), los cambios en la intensidad de las reacciones entre las fases B-A' y A-A' indicaron que el niño se adaptó a los cambios de plan y a situaciones inesperadas de una manera más adaptativa. Para el tercer comportamiento (3), los cambios en el número de saludos entre las fases A-B y A-A' sugirieron que, durante la tercera fase del estudio, el participante adquirió completamente el hábito de saludar a sus compañeros y aumentó sus interacciones con otros. En conclusión, el estudio reveló mejoras en los tres comportamientos específicos por parte del participante. Sin embargo, debido a la complejidad del tercer comportamiento, se sugiere que, en investigaciones futuras, la intervención enfocada en las interacciones sociales se prolongue para garantizar una estabilidad a largo plazo de las mejoras observadas.

El Capítulo 7 incluye el tercer estudio cuyo objetivo fue determinar la efectividad del nuevo programa de rehabilitación "SocialMind" para mejorar todos los componentes de la CS en personas con DCA. Para ello, se contó con una muestra de 31 persona con DCA, divididos en grupos experimentales y de control. El programa SocialMind, estructurado en cuatro módulos con una duración de 30 horas, abarcó el trabajo en cada uno de los componentes de la CS. Los resultados mostraron que el grupo que recibió el programa de rehabilitación SocialMind mejoró significativamente el reconocimiento de emociones, el conocimiento social y la empatía en comparación con el grupo control. La ToM también mejoró cerca de la significación. En conclusión, el programa SocialMind es efectivo para mejorar tres de los cuatro componentes clave de la CS en personas con DCA.

La cuarta sección incluye los Capítulo 8 y 9 de la Tesis Doctoral, y se dedica a la discusión general, las perspectivas futuras y las conclusiones. En el Capítulo 8

se presenta el contenido en español y en el Capítulo 9 se presenta en inglés debido a que va destinado a la obtención de la mención de Doctorado Internacional. Los resultados obtenidos en esta Tesis Doctoral han revelado que: (1) la ToMas-child se valida como una herramienta eficaz para evaluar la ToM en niños de 3 a 7 años, (2) el enfoque de metodología de caso único es apropiado para abordar déficits específicos generados por alteraciones en la CS en personas con DCA y (3) el programa de rehabilitación SocialMind se demuestra idóneo para la rehabilitación integral de la CS en individuos con DCA.

Abstract

Social Cognition (SC) is the ability that allows understanding, interpreting, and responding appropriately to social signals present in the environment and in interactions with other individuals (Spikman et al., 2012). SC encompasses complex mental processes that enable learning and understanding one's own and others' intentions, emotions, beliefs, and thoughts. SC involves the capacity to generate appropriate social responses, such as interpreting gestures and facial expressions, and adapting behavior according to the social context and others' expectations (Adolphs, 2010). Ultimately, SC stands as an essential component for achieving effective social integration, enabling individuals to navigate the social environment successfully (McDonald & Genova, 2021).

When SC is not properly developed or is affected, difficulties can arise characterized by the inability to accurately interpret one's own and others' emotions, understand and use social signals, discern the intentions of others, and adjust behavior based on social demands (Smith & Semin, 2007). These limitations impact the formation and maintenance of friendships and meaningful relationships, potentially leading to partial or total social exclusion (Spikman et al., 2012).

On many occasions, individuals who have experienced acquired brain injury (ABI) present impairments in SC. Wallis et al. (2022) revealed that at least one

component of SC shows alterations in 83.11 % of the examined cases in individuals with ABI. Despite this result, there are few instruments available to assess SC components, which is why most rehabilitation programs only focus on treating some of them, such as emotional processing and Theory of Mind (ToM) (Roelofs et al., 2017).

The overall objective of this Doctoral Thesis is to provide tools and evidence of their utility for addressing SC in children, adolescents, and adults with ABI.

This Doctoral Thesis is structured into nine chapters distributed across four sections. The first section encompasses the Introduction and comprises Chapters 1 to 3. Chapter 1 introduces the concept of SC and describes the characteristics of its main components: emotional processing, social knowledge, ToM, and empathy. Additionally, various explanatory models of SC are examined. Chapter 2 presents a review of different available instruments for evaluating SC and its components, with a special emphasis on those designed for individuals with ABI. Chapter 3 reviews different rehabilitation programs that focus on one or several components of SC. Similar to the previous chapter, programs designed for individuals with ABI are specified.

The second section of this Doctoral Thesis, which includes Chapter 4, focuses on the presentation and justification of the hypotheses and objectives of the Doctoral Thesis, indicating the relevance of the conducted research.

The third section corresponds to the Work Report and consists of Chapters 5 to 7. These chapters contain the empirical part of this Doctoral Thesis through the three conducted studies. Chapter 5 presents the first study that aimed to determine the psychometric properties of the Theory of Mind assessment scale in children: ToMas-child (Rivas-Garcia et al., 2020). For this purpose, two hundred and fifty-two Spanish children aged 3 to 7 years were evaluated in school settings. Using a Rasch analysis, it was determined that ToMas-child is a valid one-dimensional scale for assessing the main components of ToM in children.

Chapter 6 presents the second study that aimed to determine the effectiveness of using the single-case design methodology in three interventions, each aimed at improving a behavior altered by deficits in SC. These behaviors were: (1) expression of positive emotions, (2) reaction to changes in plans, and (3) greeting classmates. The development used the A-B-A' single-case methodology design, where each

behavior was addressed with a specific rehabilitation program applied over 10 sessions. The results showed that, in relation to the first behavior (1), changes between the B-A' and A-A' phases indicated improvements in the child's ability to express positive emotions. In the second behavior (2), changes in the intensity of reactions between the B-A' and A-A' phases indicated that the child adapted to plan changes and unexpected situations in a more adaptive manner. For the third behavior (3), changes in the number of greetings between the A-B and A-A' phases suggested that, during the third phase of the study, the participant fully acquired the habit of greeting peers and increased interactions with others. In conclusion, the study revealed improvements in the three specific behaviors by the participant. However, due to the complexity of the third behavior, it is suggested that, in future research, the intervention focused on social interactions be extended to ensure long-term stability of the observed improvements.

Chapter 7 includes the third study whose objective was to determine the effectiveness of the new rehabilitation program "SocialMind" in improving all components of SC in individuals with ABI. For this purpose, a sample of 31 individuals with ABI was divided into experimental and control groups. The SocialMind program, structured into four modules with a duration of 30 hours, covered work on each of the SC components. The results showed that the group receiving the SocialMind rehabilitation program significantly improved emotion recognition, social knowledge, and empathy compared to the control group. ToM also improved close to significance. In conclusion, the SocialMind program is effective in improving three out of the four key components of SC in individuals with ABI.

The fourth section includes Chapters 8 and 9 of the Doctoral Thesis, dedicated to the general discussion, future perspectives, and conclusions. Chapter 8 presents the content in Spanish, and Chapter 9 presents it in English because it is intended for obtaining the mention of International Doctorate. The results obtained in this Doctoral Thesis have revealed that: (1) ToMas-child is validated as an effective tool for evaluating ToM in children aged 3 to 7 years, (2) the single-case methodology approach is appropriate for addressing specific deficits generated by alterations in. SC in individuals with ABI, and (3) the SocialMind rehabilitation program is suitable for comprehensive rehabilitation of SC in individuals with ABI.

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Glossary

Acronyms / Abbreviations

ASC Assessment of social context test (Hynes et al., 2011)

ABI Acquired brain injury

BES Basis Empathy Scale (Jolliffe & Farrington, 2006)

BLERT Bell-Lysaker Emotion Recognition Task (Bell et al., 1997)

BLOC-S-R The Pragmatic Language subtest of the Battery of Objective and Criteria-Screening Language Revised (Puyuelo Sanclemente, 2007)

CS Cognición Social

CTE Context Test of Emotion (Braun et al., 1989)

DANVA Diagnostic Assessment of Nonverbal Accuracy scale (Nowicki & Duke, 1994))

DCA Daño Cerebral Adquirido

EQ Empathy Quotient (Baron-Cohen et al., 2004)

FEDT Facial Emotion Discrimination Test (Kerr & Neale, 1993)

FEEST Facial Expression of Emotion: Stimuli and Test (Young et al., 2002)

FEIT Facial Emotion Identification Task (Kerr & Neale, 1993)

IECA Index of Empathy for Children and Adolescents (Bryant, 1982)

IRI Interpersonal Reactivity Index (Davis, 1996)

MASC Movie for the Assessment of Social Cognition (Dziobek et al., 2006)

MATRICS Measurement and Treatment Research to Improve Cognition in Schizophrenia

NAP Non-overlap of all pairs

PERE Prueba de Evaluación del Reconocimiento de Emociones (Gil-Sanz et al., 2017)

PONS Profile of Nonverbal Sensitivity (Ambady et al., 1995)

QCAE Questionnaire of Cognitive and Affective Empathy (Reniers et al., 2011)

RAD Relationships Across Domains (Sergi et al., 2009)

RoBiNT Risk of Bias in Trials Scale N of 1

S-HTEM Split-half trend estimation method

SC Social Cognition

SCED Single-case experimental designs

SCRIBE Single-case reporting guideline in Behavioral Interventions

SCRT Social Cues Recognition Test (Corrigan & Green, 1993)

SCRT-R Schema Compression Sequencing Test-Revised (Corrigan & Addis, 1995)

SFRT Situational Features Recognition Test (Corrigan & Green, 1993)

TBI Traumatic Brain Injury

TEQ Toronto Empathy Questionnaire (Spreng et al., 2009)

ToM Teoría de la Mente / Theory of mind

ToMas-child The ToM Assessment Scale in children (Rivas-Garcia et al., 2020)

VAPT Videotape Affect Perception Test (Bellack et al., 1996))

"Es tan lindo saber que usted existe Uno se siente vivo Y cuando digo esto, quiero decir contar Aunque sea hasta dos, aunque sea hasta cinco No ya para que acuda, presurosa, en mi auxilio Sino para saber, a ciencia cierta Que usted sabe que puede contar conmigo."

Mario Benedetti

1

INTRODUCCIÓN. Cognición Social: Definición, componentes y alteración en personas con Daño Cerebral Adquirido

A finales del siglo XIX y principios del XX los estudios publicados por Darwin en "The Expression of the Emotions in Man and Animals" (1872) y Cooley en "Human nature and the social order" (1902) supusieron el punto de partida de la investigación centrada en entender el comportamiento social, una de las principales capacidades que diferencia a las personas del resto del reino animal. Apenas se estaba comenzando y la investigación era muy escasa, pero Cooley ya formuló la hipótesis de que para poder conocer a los demás debemos conocernos a nosotros mismos pero que no podemos conocernos a nosotros mismos sin conocer a los demás.

Es decir, hipotetizó que no es posible el conocimiento completo por separado sino que el adquirido sobre uno se convierte también en el conocimiento sobre el otro (Cooley, 1902).

Posteriormente, el interés en la naturaleza del comportamiento social humano fue incrementando y autores como Chester (1946) o Bruner y Tagiuri (1954) se centraron en investigar aspectos específicos, como la capacidad que permite al individuo reconocer y juzgar las emociones expresadas por los demás. Autores como Mead (1934) o Heider (1958) se centraron en estudiar los motivos que llevan a la persona a actuar de formas determinadas, incluyendo la influencia que tiene en ese comportamiento la percepción que tienen los demás de esa persona. A finales de los sesenta del siglo XX, Heider (1967) señaló que la imagen que tenemos de nosotros mismos y de los demás no suele venir determinada por una información concreta, sino que la formamos en función de las interacciones de una serie de datos. A la capacidad que nos permite percibir e interpretar estos datos la denominó Cognición Social (Heider, 1967). Desde ese momento, diversos autores comenzaron a aportar definiciones del término Cognición Social (CS).

Entre las primeras definiciones encontramos la de Enright (1976), para quien la CS es la capacidad que permite deducir la información de las situaciones sociales, mientras que para Lewis y Brooks-Gunn (1979), en línea de la hipótesis de Cooley (1902), la CS es la relación existente entre tres aspectos del conocimiento: el conocimiento de yo, el conocimiento de los demás y el conocimiento de las propias relaciones con los demás.

En los ochenta, el estudio de la CS fue tomando relevancia y, aunque no se contaba con instrumentos estandarizados, se realizaron importantes estudios con personas con autismo (Dawson & Fernald, 1987), daño cerebral (Warschausky et al., 1997) y esquizofrenia (Hogarty & Flesher, 1999). Ya en 2003, la reunión del comité "Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS)", declaró la importancia que tenía la CS en el desarrollo social de las personas y se estableció incluir este dominio en la evaluación de las personas con esquizofrenia (Green et al., 2005). A partir de este momento el estudio de la CS ganó especial relevancia y en la práctica clínica su evaluación más detallada se extendió también a otras poblaciones.

Fue en este momento cuando aparecieron definiciones más completas y que incluían componentes específicos, por ejemplo, la de Striano y Reid (2006), que consideraban la CS como la capacidad que permite comprender a los demás y abarca desde la comprensión de las expresiones faciales hasta la comprensión de la comunicación simbólica. Una definición posterior incluyó efectos o resultados concretos, al considerar la CS como la capacidad que permite a la persona reflexionar sobre el cono-cimiento de uno mismo, diferenciar el conocimiento propio del conocimiento de los demás y tener en cuenta dicha información para orientar la comunicación y las acciones sociales (Newsome et al., 2010). Y posteriormente, la conceptualización de la CS se parece mucho a las actuales al definirla como un constructo amplio en el que se pueden distinguir distintos aspectos como la percepción social, la teoría de la mente o la empatía, gracias a los cuales el individuo puede comprender el comportamiento de los demás y reaccionar adecuadamente en situaciones sociales (Spikman et al., 2012).

Actualmente, aunque no existe una definición de consenso, es ampliamente aceptado que la CS es la capacidad que permite (1) percibir, entender e interpretar las intenciones, sentimientos y pensamientos propios y de los demás y (2) generar conductas sociales adaptativas para poder guiar el comportamiento social de manera flexible (Adolphs, 2010; McDonald & Genova, 2021). En otras palabras, gracias al desarrollo de la CS en el ser humano este puede relacionarse con el medio y con sus iguales de forma efectiva (Atenas et al., 2019; Fiske & Taylor, 2008).

El desarrollo adecuado y mantener una buena CS es clave en la integración social de la persona (Frith, 2008). Las personas que presentan deterioro en esta capacidad tienen dificultades para comprender las emociones, entender las reglas sociales o el punto de vista de los demás (Smith & Semin, 2007) que impiden la adecuada relación con los demás y con el medio social, llegando hasta el extremo de provocar aislamiento social (Spikman et al., 2012). Este es el caso de las personas con daño cerebral adquirido (DCA), que no sólo suelen presentar alteraciones sensoriales, cognitivas y motóricas, sino también de la CS que pueden alterar la vida cotidiana de la persona y de su familia (Emilien & Waltregny, 1996). Por ello, además de los ámbitos tradicionales de la rehabilitación, como la recuperación física o cognitiva, tanto los equipos de atención clínica como los investigadores, ponen de manifiesto la

necesidad de intervenir en los déficits sociales e interpersonales (Turner-Stokes & Wade, 2004).

Los estudios de prevalencia de los déficits en CS tras un DCA muestran cifras variables, pero, en cualquier caso, altas. Cuando la investigación de este constructo en DCA estaba iniciándose, Starksteing et al. (1994) señaló que el 49 % de las personas que habían sufrido un ictus tenían alterada esta capacidad. Más adelante, Babbage et al. (2011) encontraron que del 13 % al 39 % de las personas con DCA de moderada a grave tenían dificultades significativas en el reconocimiento facial de las emociones. Por otra parte, Sensenbrenner et al. (2020) mostraron que después de sufrir un accidente cerebrovascular el 46.5 % de su muestra tenía puntuaciones bajas en reconocimiento de emociones faciales y el 34.2 % en conocimiento social o "faux pas". Adams et al. (2019) realizaron un metaanálisis de 58 conjuntos de datos con 2567 participantes (937 con accidente cerebrovascular y 1630 controles no clínicos) y los resultados indicaron que tres de los cuatro dominios centrales de la función cognitiva social (procesamiento emocional, conocimiento social y teoría de la mente) estaban significativamente deteriorados en personas con accidente cerebrovascular. En cuanto a la recuperación del déficit, después de un traumatismo craneral las alteraciones de la CS persisten durante al menos cuatro años en adultos (Theadom et al., 2019) y dos años en niños (Anderson et al., 2017).

Por todo ello y, dada la influencia de la CS en el funcionamiento social de la persona y la prevalencia de deterioro que suele presentar una persona tras un DCA, es fundamental que las deficiencias sociales se evalúen adecuadamente para lograr una identificación temprana e iniciar una intervención precoz (McDonald, English, et al., 2013). Sin embargo, Kelly et al. (2017) realizó una investigación dónde participaron 443 clínicos de todo el mundo para determinar si las personas con DCA veían alterada la CS. Los resultados mostraron que el 84 % de los clínicos afirmaban que más de la mitad de sus pacientes con DCA tenían deficiencias en la CS y que, a pesar del porcentaje tan elevado, el 78 % de los encuestados aseguraron que nunca o con poca frecuencia evaluaban esta capacidad debido a la escasez de pruebas validadas para llevar a cabo la evaluación. Tradicionalmente, la evaluación de las deficiencias sociales se ha llevado a cabo mediante pruebas neuropsicológicas generales (McDonald & Flanagan, 2004). Sin embargo, estos instrumentos dificultan detectar el déficit en CS (Spikman et al., 2012).

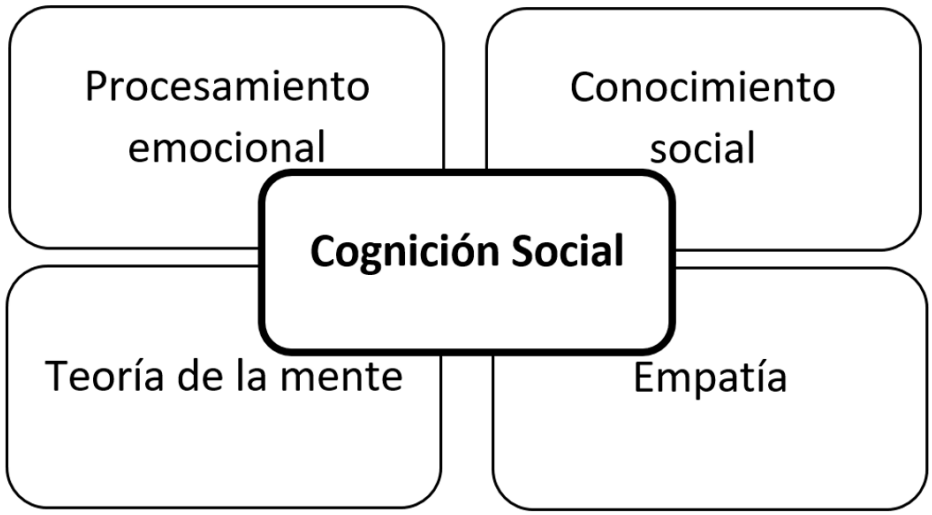

Fig. 1.1 Componentes de la Cognición Social.

En España, según los datos de la Encuesta de Discapacidad, Autonomía Personal y Situaciones de Dependencia publicados por el Instituto Nacional de Estadística (INE) en 2022, viven más de 435,400 personas con DCA y cada año se dan más de 104,701 nuevos casos. Sin embargo, solo existen 92 recursos con 4332 plazas de atención de las cuales 751 son plazas públicas, 1339 concertadas y 2242 privadas (Instituto Nacional de Estadística, 2022). Estos datos ponen de manifiesto la necesidad de disponer de instrumentos válidos que faciliten la labor de los clínicos en la evaluación y programas de rehabilitación eficientes que permitan que la rehabilitación de la CS sea una realidad para todas las personas que la necesitan.

Para facilitar esta labor, desde el ámbito de la investigación se han propuesto cuáles son los componentes que conforman esta capacidad. La CS es una capacidad compleja formada por diversas habilidades que permiten (1) identificar emociones, (2) inferir los pensamientos de los demás y (3) reaccionar emocionalmente ante diversas situaciones interpersonales (Arioli et al., 2018). Entre los componentes que han alcanzado mayor consenso se encuentran el procesamiento emocional, el conocimiento social, la teoría de la mente y la empatía (Cassel et al., 2016), como se muestra en la Fig. 1.1.

1.1 Procesamiento emocional

El procesamiento emocional hace referencia a la capacidad que permite la percepción y el uso de las emociones de forma adaptativa (Green et al., 2008; Green & Horan, 2010). Esta capacidad se divide en tres subdominios: (1) comprensión emocional, o habilidad para comprender el concepto de las diferentes emociones (Salovey & Mayer, 1990); (2) reconocimiento de emociones, o habilidad para detectar, reconocer y juzgar el valor afectivo de estímulos lingüísticos (palabras, frases y prosodia) y no lingüísticos (expresiones faciales y dirección de la mirada) (Carter et al., 2009) y; (3) regulación emocional, o proceso donde los individuos influyen en las emociones que experimentan en términos de cuáles, cuándo y cómo las experimentan y expresan (Livingstone et al., 2009).

El estudio del procesamiento emocional comenzó de la mano de Darwin (1872) cuando analizó y comparó la expresión de diferentes emociones entre animales-personas y personas de diferentes culturas, concluyendo que la expresión de las emociones era algo innato. Sin embargo, no fue hasta el año 1976 cuando Ekman retomó la investigación del procesamiento emocional encontrando que hay diferencias entre las diferentes culturas pero que existen seis emociones básicas que son comunes en la mayoría de ellas: alegría, tristeza, miedo, enfado, desagrado y sorpresa (Ekman & Friesen, 1976). Actualmente, diversos estudios han mostrado la influencia que la cultura tiene en la adquisición de este componente y en la forma de expresión de cada emoción (Jack et al., 2014).

Históricamente, la evaluación del procesamiento emocional se ha limitado a test que evalúan la expresión facial (Murphy et al., 2021). Algunos de los instrumentos más utilizados son: "Pictures of Facial Affect" (POFA) (Ekman & Friesen, 1976), "Facial Expression of emotion" (FEEST) (Young et al., 2002) y "Facial Emotion Identification Task" (FEIT) (Kerr & Neale, 1993). Sin embargo, para llevar a cabo una evaluación exhaustiva se debe incluir el reconocimiento de las emociones en el lenguaje, aunque la mayoría de las investigaciones no incluyen este aspecto (Schmidt et al., 2010). Algunos de los instrumentos diseñados para este fin son el "Voice emotion identification test" (Kerr & Neale, 1993) o el "Diagnostic assessment of nonverbal accuracy scale (DANVA) (Nowicki & Duke, 1994).

El procesamiento emocional es un domino de la CS clave tanto para la comunicación social efectiva (McDonald, English, et al., 2013) como para las habilidades de integración (Knox & Douglas, 2009), por lo que las personas que presentan alguna alteración del mismo suelen tener mermada su capacidad de relacionarse y no logran una plena integración en los grupos sociales (Cooper et al., 2014).

Una de las causas de alteración del procesamiento emocional es el DCA, que provoca frecuentemente déficits en para el reconocimiento de las emociones (Croker & McDonald, 2005). Teniendo en cuenta la implicación que este deterioro tiene en el desarrollo social de la persona, los expertos proclaman que es necesario crear nuevos programas de entrenamiento específico para paliar este déficit (Bornhofen & Mcdonald, 2008) dada la escasez actual de programas eficaces dirigidos a personas con DCA (Murphy et al., 2021). Para ello se debe tener en cuenta la influencia que la cultura tiene en el desarrollo de esta capacidad (Lancelot & Gilles, 2019), incluyendo en los programas de rehabilitación una atención específica a las características culturales de la población a la que van dirigidos.

1.2 Conocimiento social/Percepción social

No existe una definición unánime con relación a este componente de la CS. Una corriente considera que el conocimiento social es la capacidad para comprender y aprender las normas de los diferentes contestos (Henry & Solari, 2022) y la percepción social es definida como la habilidad para identificar e interpretar este conocimiento en contextos reales (McDonald & Flanagan, 2004). Sin embargo, otros autores utilizan los términos conocimiento/percepción social para referirse indistintamente al mismo constructo y unifican ambas definiciones para crear una única definición. En el desarrollo de esta tesis, hemos optado por utilizar la definición más holística del concepto y referirnos al mismo como conocimiento social, entendido como la capacidad que permite (1) comprender las normas, los roles y el protocolo de los diferentes contextos (Green & Horan, 2010), e (2) identificar e interpretar este conocimiento en situaciones sociales específicas (Addington et al., 2006; Lima et al., 2020).

El conocimiento social es fundamental para que la persona entienda qué comportamiento puede y se espera que lleve a cabo en cada situación y así poder desarrollar

una conducta adaptativa (McDonald, Honan, et al., 2013). Las personas con DCA suelen presentar déficits en conocimiento social, por lo que desarrollan conductas antisociales o consideradas poco apropiadas que les llevan al deterioro de sus relaciones (Milders, 2019). Su comportamiento puede llegar a ser tan desadaptativo que con frecuencia provoca una pérdida de empleo (Tomberg et al., 2007). Sin embargo, los programas dirigidos a personas con DCA que incluyen entrenamiento del conocimiento social son muy escasos (Garzon et al., 2022), por lo que sería necesario diseñarlos de manera más completa, sin excluir este componente de la CS.

1.3 Teoría de la Mente

La teoría de la mente (ToM) es considerada uno de los componentes principales de la CS (Lewis & Carpendale, 2014). Premarck y Woodruff (1978) fueron los primeros autores en definir esta capacidad en el estudio titulado "Does the chimpanzee have a theory of mind?". En esta investigación, la ToM fue definida como la capacidad que permite inferir los estados mentales que no son directamente observables, como los pensamientos, creencias y/o gustos (Premack & Woodruff, 1978). La investigación de la ToM poco a poco fue ganando relevancia y, con ello, se fue perfilando su definición. Heyes (1998) la definió como la habilidad que permite a la persona (1) comprender conceptos como "creer", "saber", "querer", y (2) utilizar dichos conceptos para predecir y explicar el comportamiento. Más adelante, Begeer (2003) la definió como la capacidad que nos permite entender los estados mentales, como creencias, deseos e intenciones; y comprender que el comportamiento suele estar regulado por dicha información y no por la realidad objetiva. Actualmente, una definición de ToM muy extendida la conceptualiza como la capacidad para entender los estados mentales de los demás (intereses, creencias, emociones e intenciones), predecir su comportamiento y comprender que estos estados mentales pueden ser diferentes a los de uno mismo y diferir de la realidad (Achim et al., 2013).

El desarrollo de la ToM se produce de forma gradual, siendo claves los primeros cinco años de vida (Povinelli & Preuss, 1995). Además, en la adquisición de la ToM influyen factores como el desarrollo del leguaje y la cultura. En relación al lenguaje, conforme se va adquiriendo más léxico y mayor complejidad sintáctica, el desarrollo de la ToM es más rápido y mejor, debido a que se comprenden de forma

más adecuada las acciones tanto propias como ajenas (Resches et al., 2010). En cuanto al desarrollo de la ToM en personas de distintas culturas, el proceso evolutivo de su adquisición no es idéntico debido a la influencia que ejercen factores como por ejemplo, el grado de aplicabilidad o visión práctica de los conceptos que se transmite a través de los agentes de socialización (Wellman et al., 2006).

Una de las características más destacables de la ToM es tener como resultado que seamos capaces de comprender el punto de vista de los demás, por lo que es fundamental para mantener relaciones sociales exitosas (Fazaeli et al., 2018). También después de un DCA son frecuentes los déficits en ToM tanto en niños (Ju et al., 2021) como en adultos (Lin et al., 2021). Como se ha mencionado antes, los instrumentos de evaluación deben estar validados para la cultura específica, y en población española son escasos (Fernández García et al., 2021). Y en relación a la rehabilitación de la ToM, los programas con eficacia para personas con DCA también son escasos (Cassel et al., 2016; Loubat et al., 2019).

1.4 Empatía

La empatía es la capacidad que nos permite comprender, compartir y responder a las experiencias emocionales de los demás adecuando nuestra conducta a sus necesidades/demandas (Green et al., 2015). Se trata de una habilidad compleja en la que algunos autores diferencian dos componentes: empatía cognitiva y empatía emocional. La empatía cognitiva sería la capacidad que permite predecir, entender y adoptar el punto de vista de los demás (Laghi et al., 2019), mientras que la empatía emocional sería la que permite experimentar reacciones afectivas frente a la experiencia observada de los demás, adecuando nuestra conducta a dicha información (Sousa et al., 2012).

Al igual que ocurre con el concepto de conocimiento/percepción social, con relación a la empatía también podemos encontrar dos enfoques de definición. Por un lado, encontramos un modelo dónde se diferencia entre ToM, empatía cognitiva y empatía emocional. En este modelo, la ToM es definida como la capacidad de entender la mente de los demás; la empatía cognitiva como la capacidad de adoptar ese punto de vista como propio y, por último, la empatía emocional, como la capacidad de entender las reacciones afectivas de los demás y ponerse en su lugar

(Decety & Yoder, 2016; Gabay et al., 2016). Por otro lado, otro enfoque considera sinónimos los términos de ToM y empatía cognitiva y los define como la capacidad para entender los estados mentales de los demás (intereses, creencias, emociones e intenciones), predecir su comportamiento y comprender que estos estados mentales pueden ser diferentes a los de uno mismo y diferir de la realidad (Dvash & Shamay-Tsoory, 2014; Smith, 2006). Este segundo enfoque sitúa la empatía emocional como un aspecto bien diferenciado de los anteriores y la define como la capacidad de comprender, compartir y responder a las experiencias emocionales de los demás adaptando el propio comportamiento para tener una respuesta flexible (Laghi et al., 2019). En el desarrollo de esta tesis hemos adoptado el segundo enfoque, donde ToM y empatía cognitiva se consideran sinónimos y nos referiremos a la empatía emocional simplemente como empatía.

La empatía también resulta clave para que la persona pueda relacionarse de forma efectiva con los demás y con el entorno (Vales, 2022). Las personas con DCA tienen frecuentemente déficits de empatía (Vales, 2022) que dificultan enormemente su adecuada integración social (McDonald, Honan, et al., 2013). Sin embargo, son escasos los programas de rehabilitación dirigidos a trabajar este componente de la CS en DCA (Fernández-Sotos et al., 2019).

1.5 Modelos explicativos de la Cognición Social

Diversas investigaciones han estudiado cómo se desarrollan cada uno de los componentes de la CS y la relación que mantienen entre ellos. Tres modelos explicativos de la CS son los más extendidos: Frith y Frith (2008), Ochsner (2008) y McDonald (2013).

El modelo de Frith y Frith (2008) se basa en la diferenciación entre los procesos implícitos y explícitos de la CS. Los procesos implícitos son aquellos que se producen de forma automática, por lo que la persona no tiene control sobre ellos (por ejemplo, la emoción sentida en una determinada situación). Los procesos explícitos son aquellos voluntarios que la persona realiza de forma consciente (por ejemplo, cuando una persona expresa una emoción diferente a la que realmente está sintiendo). Este modelo sostiene que el comportamiento social es el resultado del equilibrio entre ambos procesos, que se produce cuando la persona hace una adecuada integración

identificando los procesos implícitos (procesamiento emocional) y siendo capaz de amoldar su comportamiento teniendo en cuenta las normas sociales y los sentimientos de los demás (procesos explícitos) (Frith & Frith, 2008).

El modelo de Ochsner (2008) establece que los componentes de la CS se adquieren de forma jerárquica (Fig. 1.2). En concreto, establece que los diferentes componentes se agrupan en cinco niveles: (1) Adquisición de valores y respuestas socioafectivas, (2) Reconocimiento y respuesta a estímulos socioafectivos, (3) Inferencia de estados mentales de bajo nivel, (4) Inferencia de estado mental de alto nivel y (5) Regulación sensible al contexto. En el primer nivel, la persona es capaz de identificar las emociones que siente en cada situación y aprender cuáles son las normas de comportamiento socialmente aceptadas. En el segundo nivel, la persona es capaz de generar una respuesta teniendo en cuenta la información adquirida en el primer nivel. En el tercer y cuarto nivel, la persona procesa la información que percibe considerando la perspectiva de quienes la rodean. En un primer momento, con situaciones simples (tercer nivel) hasta llegar a situaciones complejas que involucran a más de un individuo (cuarto nivel). Por último, en el quinto nivel, la persona genera una respuesta más adaptativa y flexible debido a que es capaz de aunar toda la información obtenida en cada nivel en una única respuesta. En este nivel es cuando la persona alcanza el comportamiento social (Ochsner, 2008).

Por último, el modelo de McDonald (2013) diferencia entre CS fría y caliente. Esta autora es una de las que más investigación ha realizado con personas con DCA y sostiene que los componentes de la CS se pueden dividir entre procesos racionales (CS fría) y procesos emocionales (CS caliente). En concreto, establece que la ToM es el componente frío que se relaciona con los procesos racionales, mientras que el resto de componentes se agrupan en la categoría CS caliente (Wilson et al., 2017). El comportamiento social es el resultado de generar una conducta teniendo en cuenta la información obtenida por ambos procesos (McDonald, 2013).

En conclusión, todos los modelos muestran que la conducta social es el resultado de generar una única respuesta teniendo en cuenta la información obtenida en cada una de las capacidades que conforman la CS.

En resumen, el estudio de la CS ha evolucionado desde los primeros trabajos de Darwin y Cooley hasta la comprensión actual de sus componentes clave: procesamiento emocional, conocimiento social, ToM y empatía. La CS desempeña un

Fig. 1.2 Modelo de cognición social de Ochsner (2008).

papel fundamental en la interacción social, pero la evaluación y rehabilitación aún enfrentan obstáculos debido a la falta de herramientas validadas. Los modelos como el de Frith y Frith (2008), Ochsner (2008) y McDonald (2013) proporcionan enfoques para comprender la interconexión de los componentes de la CS. Las personas con DCA a menudo experimentan déficits en estos aspectos, lo que impacta en su vida social y emocional, dificultando la adaptación en la sociedad.

"Prefiero una libertad peligrosa a una servidumbre tranquila."

María Zambrano

2

INTRODUCCIÓN. Evaluación de la Cognición Social en personas con Daño Cerebral Adquirido

2.1 Instrumentos para evaluar la Cognición Social y sus componentes

En el capítulo anterior se ha mostrado que para un desarrollo íntegro de la persona es necesario relacionarse eficazmente con los demás y el entorno social (Atenas et al., 2019) y que la Cognición Social (CS) es la capacidad que permite lograr adecuadamente esa relación (Fiske & Taylor, 2008). La CS se encuentra alterada en diversos trastornos como el autismo (Pavlova et al., 2017), la esquizofrenia

(Corrigan & Green, 1993), el TDAH (Maoz et al., 2019), la discapacidad intelectual (Cook & Oliver, 2011) o el daño cerebral adquirido (DCA) (Wearne et al., 2021). En la Tabla 2.1 se muestra un listado de instrumentos utilizados para evaluar la CS y determinar el grado de desarrollo o déficit cada uno de los componentes. Esta relación de instrumentos se ha generado mediante una revisión de artículos relacionados con la evaluación e intervención de la CS en diversas poblaciones. A continuación, se presentan algunas de las características más destacadas de cada uno de los instrumentos.

2.1.1 Evaluación del Procesamiento Emocional

Pictures of Facial Affect (Ekman & Friesen, 1976)

Este instrumento consta de 110 representaciones faciales que muestran algunas de las seis emociones básicas (felicidad, asco, miedo, tristeza, aburrimiento y sorpresa). Todas las imágenes son en blanco y negro y la intensidad de la emoción expresada varía en cada fotografía. Existe una versión reducida que consta de 60 imágenes denominada "Ekman 60 Faces" que ha sido ampliamente comercializada y es la más utilizada en investigaciones para evaluar el reconocimiento facial de las emociones. En ambas versiones, el participante debe discernir la emoción que se está manifestando en cada imagen, eligiendo entre las seis opciones disponibles. La puntuación se calcula mediante la suma de los ítems respondidos de manera correcta. Un ejemplo de las imágenes utilizadas en este instrumento se muestra en la Fig. 2.1

Facial Emotion Identification Task (FEIT) (Kerr & Neale, 1993)

Esta tarea está formada por 19 imágenes faciales que muestran algunas de las seis emociones básicas (felicidad, asco, miedo, tristeza, aburrimiento y sorpresa). Tras la presentación de cada una de ellas, la persona debe identificar la emoción que presentaba el rostro que se ha enseñado y elegir una entre las seis alternativas posibles. Cada imagen se muestra durante 15 segundos. La puntuación se obtiene por la suma de ítems contestados correctamente.

Table 2.1 Resumen de los instrumentos para evaluar los componentes de la Cognición Social.

Procesamiento emocional
Pictures of Facial Affect (Ekman & Friesen, 1976)
Facial Emotion Identification Task (FEIT) (Kerr & Neale, 1993)
Facial Emotion Discrimination Test (FEDT) (Kerr & Neale, 1993)
Voice Emotion Identification Test (Kerr & Neale, 1993)
Diagnostic Assessment of Nonverbal Accuracy scale (DANVA) (Nowicki & Duke, 1994)
Bell-Lysaker Emotion Recognition Task (BLERT) (Bell et al., 1997)
Faces Test (Baron-Cohen et al., 1997)
Facial Expression of Emotion: Stimuli and Test (FEEST) (Young et al., 2002)
Prueba de Evaluación del Reconocimiento de Emociones (PERE) (Gil-Sanz et al., 2017)
Conocimiento social/Percepción social
Context Test of Emotion (CTE) (Braun et al., 1989)
Social Cues Recognition Test (SCRT) (Corrigan & Green, 1993)
Situational Features Recognitions Test (SFRT) (Corrigan & Green, 1993)
Profile of Nonverbal Sensitivity (PONS) (Ambady et al., 1995)
Schema Compression Sequencing Test-Revised (SCRT-R) (Corrigan & Addis, 1995)
Videotape Affect Perception Test (VAPT) (Bellack et al., 1996)
Relationships Across Domains (RAD) (Sergi et al., 2009)
Faux Pas Task (Stone et al., 1998)
Teoría de la Mente
Assessment of social context test (ASC) (Hynes et al., 2011)
Movie for the Assessment of Social Cognition (MASC) (Dziobek et al., 2006)
Stories of Everyday Life (Kaland et al., 2002) (Versión en español de Lera et al. (2016))
Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001)
Strange Stories Task (Happé, 1994; White et al., 2009)
Silent Film Task (Devine & Hughes, 2013)
Awkward Moments Task (Heavey et al., 2000)
Hinting Task (Corcoran et al., 1995)
Empatía
Index of Empathy for Children and Adolescents (IECA) (Bryant, 1982)
Interpersonal Reactivity Index (IRI) (Davis, 1996)
Basis Empathy Scale (BES) (Jolliffe & Farrington, 2006)
Empathy Quotient (EQ) [Adult version of Baron-Cohen et al. (2004); Adolescent version of Auyeung et al. (2012); Child version of Auyeung et al. (2009)]
Questionnaire of Cognitive and Affective Empathy (QCAE) (Reniers et al., 2011)
Toronto Empathy Questionnaire (TEQ) (Spreng et al., 2009)

Fig. 2.1 Ejemplos del Pictures of Facial Affect (Ekman & Friesen, 1976).

Facial Emotion Discrimination Test (FEDT) (Kerr & Neale, 1993)

Este instrumento incluye 30 pares de rostros de personas del mismo sexo. Las fotografías se presentan por parejas y hay que decidir si ambos rostros expresan la misma emoción. Las emociones expresadas son, al igual que en los instrumentos anteriores, las seis básicas. La puntuación se obtiene por la suma de ítems contestados correctamente.

Voice emotion identification test (Kerr & Neale, 1993)

Este test está formado por 21 frases neutrales pronunciadas por voces tanto masculinas como femeninas con una entonación que trata de mostrar una de las seis emociones básicas (felicidad, asco, miedo, tristeza, aburrimiento y sorpresa). Tras presentar cada frase, se pide al examinado que identifique la emoción, de las seis opciones posibles, con la que ha sido pronunciada. La puntuación se obtiene por la suma de ítems contestados correctamente.

Diagnostic assessment of nonverbal accuracy scale (DANVA) (Nowicki & Duke, 1994)

Esta escala evalúa el reconocimiento de las emociones mostradas tanto facial como vocalmente. La peculiaridad de este test es que incluye versión infantil y versión

para adultos. En ambas versiones, el reconocimiento facial está compuesto por 24 imágenes. Las emociones que se evalúan son cuatro: tristeza, enfado, felicidad y miedo). Tras la presentación de cada una de ellas, la persona debe identificar la emoción que presentaba el rostro que se ha enseñado y elegir una entre las cuatro alternativas posibles. La puntuación se obtiene por la suma de ítems contestados correctamente.

En relación a la evaluación vocal, en la versión de adultos, se presentan dos personajes que mantienen un dialogo para suscitar las 4 emociones evaluadas. La versión infantil, una niña de 10 años repite la frase, "Voy a salir de la habitación ahora, pero volveré más tarde" con un tono de voz cambiante para comunicar las emociones trabajadas. Tras la presentación de cada situación, la persona debe identificar la emoción que se presentaba y elegir una entre las cuatro alternativas posibles. La puntuación se obtiene por la suma de ítems contestados correctamente.

The Bell-Lysaker Emotion Recognition Task (BLERT) (Bell et al., 1997)

Esta prueba consta de 21 vídeos en los que un actor entona, con una de las seis emociones básicas, tres monólogos de contenido neutro. Tras la proyección de cada vídeo, se pregunta al sujeto por la emoción con la que cree que el actor ha pronunciado el monólogo, teniendo que elegir una emoción de las seis posibles opciones. La puntuación se obtiene por la suma de ítems contestados correctamente.

Faces Test (Baron-Cohen et al., 1997)

Este test mide el reconocimiento de la expresión emocional facial a través de veinte imágenes de una actriz que muestran tanto emociones básicas (feliz, triste, asustado, sorprendido, disgustado y angustiado) como estados mentales complejos (culpa, pensativo, admirando, flirteando, aburrido, interesado y arrogante). En cada imagen, se presentan dos opciones de respuesta, y el participante debe elegir una de ellas en función de la emoción o estado mental que percibe en la imagen. La puntuación se obtiene por la suma de ítems contestados correctamente. Un ejemplo de las imágenes utilizadas en este instrumento se muestra en la Fig. 2.2.

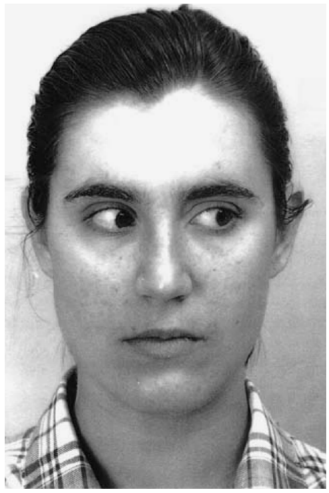

Fig. 2.2 Ejemplo del Faces Test (Baron-Cohen et al., 1997).

Facial Expression of Emotion: Stimuli and Test (FEEST) (Young et al., 2002)

La tarea consiste en identificar las emociones que se muestran en 70 imágenes. Las emociones expresadas son las seis básicas (10 imágenes por cada una de las seis emociones básicas), más diez imágenes neutras. Este test se encuentra en versión digital. El participante debe identificar la emoción que se está manifestando en cada imagen, eligiendo entre las seis opciones disponibles. La puntuación se obtiene por la suma de ítems contestados correctamente y, al finalizar la administración, el programa muestra tanto el número de aciertos globales como el obtenido en cada emoción.

Prueba de Evaluación del Reconocimiento de Emociones (PERE) (Gil-Sanz et al., 2017)

Esta prueba consta de 56 rostros que muestran algunas de las seis emociones básicas (felicidad, asco, miedo, tristeza, aburrimiento y sorpresa). Además, también incluye fotografías con expresión neutra.

Fig. 2.3 Prueba de Evaluación del Reconocimiento de Emociones (PERE) (Gil-Sanz et al., 2017).

La puntuación se obtiene por la suma de ítems contestados correctamente. El participante observa las imágenes en una presentación de PowerPoint y selecciona la respuesta correcta en una hoja de respuesta, eligiendo una de las seis emociones posibles. Un ejemplo de las imágenes utilizadas en este instrumento se muestra en la Figura 2.3. Este test es gratuito y se puede descargar del siguiente link: http://www.proyectoscores.es/pere.php.

2.1.2 Evaluación del Conocimiento Social/Percepción Social

Context test of Emotion (CTE) (Braun et al., 1989)

Esta prueba se compone de 36 audios dónde el participante debe identificar la emoción expresada en cada uno de ellos. Las situaciones presentadas son escenarios dónde socialmente está establecido cómo una persona debe sentirse o comportarse, por lo que, a través del contexto proporcionado, se puede deducir cuál de las seis emociones fundamentales está experimentando el personaje. El participante debe indicar cuál de estas seis emociones está siendo experimentada por el personaje en cada situación. Ejemplo: "Estoy yendo al funeral de un amigo" (tristeza) o "estoy abriendo un regalo de cumpleaños" (felicidad). La puntuación se obtiene por la suma de ítems contestados correctamente.

Social Cues Recognition Test (SCRT) (Corrigan & Green, 1993)

En este test se muestran ocho situaciones en las que aparecen dos o tres personas hablando entre sí. Cada escena dura 60 segundos. Al finalizar la visualización de cada situación, la persona debe completar un cuestionario compuesto por 36 ítems dónde debe indicar con verdadero o falso si durante la visualización de la escena la acción que se concreta ha cumplido las normas sociales. Un ejemplo de situación es: "Fran tiro sus cartas al final de la partida" o "María dijo, ¡caramba, qué televisión tan buena!". La puntuación se obtiene por la suma de ítems contestados correctamente.

Situational Features Recognitions Test (SFRT) (Corrigan & Green, 1993)

Este test evalúa la capacidad de reconocer y comprender las claves sociales y situacionales en diferentes contextos. Es una prueba de papel y lápiz dónde los participantes deben identificar las emociones expresadas, las pistas contextuales y las implicaciones sociales presentes tanto en cinco situaciones que le serán familiares como en otras cuatro que no serán tan conocidas. La puntuación se obtiene mediante la suma de aciertos obtenidos en cada historia.

The Profile of Nonverbal Sensivity (PONS) (Ambady et al., 1995)

Este instrumento está formado por 220 escenas que contienen expresiones faciales, entonaciones y gestos realizados por una mujer. Tras la visualización, el sujeto debe elegir cuál de las dos opciones que se le proporciona describe mejor la escena que acaba de ver. Ejemplo: las opciones de respuesta en la escena cinco son "expresar una fuerte aversión" o "ayudar a un cliente". Existe una versión mini, formada por 64 ítems que facilitaba la administración en población clínica (Bänziger et al., 2011). La puntuación se obtiene por la suma de ítems contestados correctamente.

Schema Compression Sequencing Test-Revised (SCRT-R) (Corrigan & Addis, 1995)

Esta prueba está formada por 12 viñetas dónde se describen situaciones cotidianas, como ir al cine, buscar trabajo o ir de compras. Estas situaciones se presentan desorganizadas y la persona debe ordenar los pasos que han ocurrido en cada una

de ellas. Las variables a tener en cuenta en esta prueba son la longitud de la escena (corta vs larga) y la información del contexto (si aparece el título o no). Para la evaluación, se tiene en cuenta el tiempo que tarda la persona en completar el orden de cada situación y el número de pasos que ordena seguidamente.

Videotape Affect Perception Test (VAPT) (Bellack et al., 1996)

Se muestran 30 escenas de películas y programas de televisión en las que aparecen dos personas. Una de ellas expresa una respuesta afectiva agradable o desagradable. Tras cada escena, el sujeto ha de valorar la agradabilidad o la desagradabilidad que se muestra y la intensidad de cada una de ellas, en una escala de nueve puntos.

Por último, se ha de valorar la escena al completo, especificando cuál es la emoción básica (felicidad, asco, miedo, tristeza, aburrimiento y sorpresa) que más se adecua a la expresada en la escena.

Relationships Across Domains (RAD) (Sergi et al., 2009)

Este test tiene 25 viñetas que muestran interacciones sociales llevadas a cabo entre un hombre y una mujer. Cada viñeta va seguida de tres afirmaciones que describen el comportamiento interpersonal de la pareja en ámbitos de la vida cotidiana. Se pide a los participantes que utilicen la información que tiene sobre los personajes para indicar si es probable o improbable que se produzcan los comportamientos descritos en las tres afirmaciones, respondiendo "sí" o "no". Los participantes utilizan su conocimiento implícito de los modelos relacionales para responder correctamente a los ítems. El número de ítems por viñeta con respuestas "sí" correctas (rango 0-3) es diferente para cada historia. De las 25 viñetas, ocho tienen que ver con el reparto comunitario, seis con el ranking de autoridad, seis con la igualdad y cinco con la fijación de precios. De los 75 ítems, cada viñeta tiene tres ítems, 25 se refieren a una afirmación de reparto comunitario, 25 a una afirmación de clasificación de autoridad, 14 a una afirmación de equiparación de igualdad y 11 a una afirmación de fijación de precios de mercado. El número total de respuestas correctas proporciona un índice de competencia en la percepción de las relaciones. Ejemplo de situación:

Contexto: Alan y Patty se compran regalos mutuamente cada vez que ven algo que creen que le gustaría al otro, simplemente porque les gusta hacerse felices. Hace

poco tiempo tuvieron que decidir a qué restaurante ir. En situaciones parecidas, ambos suelen eligieron el lugar que piensan que les permitiría pasar más tiempo juntos.

Pregunta: utilizando lo que ahora sabe sobre esta pareja, marque con un círculo sí o no para indicar si la pareja actuaría o pensaría de la forma descrita en cada una de las siguientes afirmaciones.

1. Alan controla el tiempo que pasa con Patty en relación con el tiempo que pasa con otras personas. (Sí) (No)

2. Patty lleva a casa todo el dinero que gana y se lo da a Alan; cuando necesita dinero para gastar, se lo pide a Alan y él se lo da. (Sí) (No)

3. Alan y Patty sienten que siempre han estado juntos y que siempre lo estarán. (Sí) (No)

The "Faux Pas" Tast (Stone et al., 1998)

Faux Pas [Versión para adultos de Stone et. al. (1998); versión española para adultos de Fernández-Modamio et al. (2018) a partir de 16 años; versión para niños de Baron-Cohen et al. (1999) entre 7-12 años]. Las dos versiones constan de veinte historias, diez de ellas con faux pas y diez de control. En la versión para adultos, los participantes tienen que responder a ocho preguntas sobre detección de faux pas, comprensión de lo inapropiado, intención del hablante, falsas creencias asociadas, emociones/empatía relacionadas y preguntas de control para asegurarse de que han entendido la historia. En la versión para niños, los participantes tienen que responder a cuatro preguntas sobre detección de faux pas, identificación, comprensión y falsas creencias. La puntuación global es una suma de aciertos en las veinte historias.

2.1.3 Evaluación de la Teoría de la Mente

Assessment of social context test (ASC) (Hynes et al., 2011)

Esta prueba está formada por diez pares de vídeos, cada uno con una duración de diez segundos. El contenido verbal de cada par es idéntico, pero la información no verbal difiere en el significado de la declaración. El objetivo de la prueba es determinar el

grado de comprensión del contexto social no verbal (identificación de emociones, intenciones y actitudes). La puntuación global es la suma de acierto en los diez pares de vídeos.

Ejemplo de situación: una mujer le dijo a un hombre: "Hacía años que no te veía", y en una de las situaciones, ella se alegró de verle, mientras que, en la otra, se mostró incómoda y poco amistosa. Después de cada escena se formularon tres preguntas sobre la intención, la emoción y la actitud del actor objetivo hacia el otro actor. Para el vídeo descrito anteriormente, las preguntas eran las siguientes:

- Intención: Cuando la mujer dijo: "Hace años que no te veo", ¿qué propósito intentaba conseguir? [Respuesta abierta].
- Emoción: ¿Qué emoción o actitud expresó la mujer cuando dijo "Hace años que no te veo"? [Respuesta abierta; elija sólo una palabra].
- Actitud: ¿Hasta qué punto era positiva o negativa la actitud de la mujer hacia el hombre? [-1 (negativo), 0 (neutro), 1 (positivo)].

Movie for the Assessment of Social Cognition (MASC) (Dziobek et al., 2006)

Movie for the Assessment of Social Cognition (MASC) (Dziobek et al., 2006) [versión española de Lahera et al. (2014)]. Este instrumento mide la ToM en personas mayores de 16 años. El MASC es una película que muestra a cuatro personajes pasando juntos una noche de sábado. Se pide a los participantes que hagan inferencias sobre los estados mentales de los personajes del vídeo. La prueba tiene en cuenta distintas modalidades de estados mentales (pensamientos, emociones, intenciones) con valencia neutra, positiva y negativa. Los participantes deben responder a 46 preguntas, cada una con cuatro opciones de respuesta, y sólo una opción es correcta. Durante el visionado del vídeo, la imagen se detiene y aparece la pregunta; una vez respondida, el vídeo sigue reproduciéndose. Las cuatro opciones de respuesta incluyen (1) atribución correcta de ToM a los personajes de la película, (2) errores de sobrementalización (MasToM), un estado mental que se atribuye cuando no hay razón para ello, (3) errores de inframentalización (MenosToM), un estado mental presente que no se atribuye, y (4) ausencia total de mentalización, una atribución de causalidad física en lugar de un estado mental. Estas respuestas pueden clasificarse

como correctas, sobrementalización, inframentalización y ausencia de mentalización. La puntuación global es la suma de aciertos. Se puede acceder a la prueba en español desde el siguiente link, la contraseña es "MASC": http://masc-cognicionsocial.es/

Stories of Everyday Life (Kaland et al., 2002) [Versión en español de Lera et al. (2016)]

Este instrumento mide la ToM en niños de 7 a 16 años. Hay 13 tipos de historias dónde se muestran mentiras, malentendido, doble farol, ironía, persuasión, emociones contrarias, olvido, celos, intenciones, empatía y/o meteduras de pata. Cada historia tiene entre 10 y 15 preguntas de control para asegurarse de que los participantes han comprendido el texto. Además, cada historia tiene tres preguntas esenciales para evaluar la capacidad del participante para inferir estados físicos y mentales a partir del contexto de la historia. Las respuestas de inferencia física e inferencia mental se puntúan como correctas (2 puntos), parcialmente correctas (1 punto) o incorrectas (0 puntos).

Reading the Mind in the Eyes Test (Baron-Cohen et al., 2001)

La prueba pretende medir la capacidad de una persona para reconocer e interpretar señales faciales sutiles, sobre todo las relacionadas con emociones y estados mentales. Para ello, se muestran 25 imágenes de los ojos de personas, recortados del resto de la cara y se le pide al participante que elijan qué emoción o estado mental describe mejor lo que siente la persona de la fotografía. Las opciones de respuesta son: felicidad, asco, miedo, tristeza, aburrimiento y sorpresa. La puntuación se obtiene por la suma de ítems contestados correctamente.

Strage Stories Task (Happé, 1994; White et al., 2009)

Esta prueba está diseñada para evaluar la capacidad de los individuos para comprender e interpretar situaciones sociales complejas y determinar las intenciones y creencias de los personajes. La tarea consiste en presentar a los participantes 24 historias cortas que contienen escenarios sociales con información ambigua o contradictoria. Cada

historia tiene una serie de preguntas para valorar la capacidad para inferir los estados mentales de los personajes, como sus intenciones, creencias, deseos o emociones. La puntuación se obtiene con la suma de la puntuación obtenida en cada historia, a cada historia se puede otorgar 0, 1 o 2 puntos.

Silent Film Task (Devine & Hughes, 2013)

La tarea está formada por cinco fragmentos de la película muda clásica de Harold Lloyd. Estos fragmentos representan escenarios humorísticos en los que las acciones o el comportamiento de un personaje se podría explicar mediante creencias erróneas. Los clips seleccionados no requerían de subtítulos y eran breves, 25.4 seg. Tras la visualización de cada vídeo, el participante debe contestar a una pregunta en la que debe describir el comportamiento de un personaje. La puntuación total se calcula sumando los aciertos obtenidos en las preguntas relacionadas con cada historia.

Awkward Moments Task (Heavey et al., 2000)

Esta prueba está formada por ocho clips, con una duración entre 45 a 120 segundos. La tarea del participante es identificar y reconocer los momentos incómodos que ocurren y proporcionar una explicación de por qué se producen. La puntuación total se calcula sumando los aciertos obtenidos en las preguntas relacionadas con cada historia.

Hinting Task (Corcoran et al., 1995)

Este instrumento está formado por 10 historias cortas dónde se muestra la interacción entre dos personajes, dónde uno de ellos proporciona una pista a otra persona, quien luego responde a la pista. El participante debe explicar lo que el personaje de la historia ha intentado comunicar mediante la indirecta que ha dicho. Esta tarea proporciona información sobre la capacidad de un individuo para inferir intenciones, creencias y emociones a partir de la comunicación indirecta. La puntuación se obtiene con la suma de la puntuación obtenida en cada historia.

2.1.4 Evaluación de la Empatía

Index of Empathy for Children and Adolescents (IECA) (Bryant, 1982)

Este cuestionario evalúa la capacidad empática en niños y adolescente. Está formado por 22 ítems donde se presentan situaciones de la vida cotidiana. En la realización, son los padres/tutores de los menores quienes cumplimentan el cuestionario indicando si la afirmación muestra el comportamiento del menor. La puntuación se obtiene con la suma de la puntuación obtenida en cada ítem.

Interpersonal Reactivity Index (IRI) (Davis, 1996)

Este instrumento consta de cuatro subescalas, cada una de las cuales representa una faceta diferente de la empatía:

1. Toma de perspectiva: esta subescala evalúa la tendencia a adoptar espontáneamente el punto de vista psicológico de los demás. Las personas que toman mucha perspectiva son buenas para comprender los pensamientos y sentimientos de los demás. Esta habilidad es también conocida como ToM.

2. Fantasía: esta subescala mide la tendencia a trasladarse imaginativamente a situaciones o personajes ficticios. Las personas con mucha fantasía tienden a tener una alta imaginación y pueden sumergirse fácilmente en historias o escenarios hipotéticos.

3. Preocupación empática: esta subescala evalúa los sentimientos de compasión y preocupación por otras personas que experimentan emociones negativas o dificultades. Las personas con gran preocupación empática son sensibles a las emociones de los demás y, a menudo, sienten el deseo de ayudarlos o apoyarlos.

4. Angustia personal: esta subescala evalúa los sentimientos de incomodidad personal o ansiedad en respuesta a la angustia de los demás. Refleja una respuesta más auto-orientada a las emociones de los demás.

El IRI generalmente se administra en forma de cuestionario de autoinforme, donde las personas califican su acuerdo con una serie de declaraciones que reflejan

cada una de las cuatro dimensiones relacionadas con la empatía. Las puntuaciones más altas indican un mayor nivel de empatía. La puntuación global es la suma de las puntuaciones de cada ítem.

Basis Empathy Scale (BES) (Jolliffe & Farrington, 2006)

Este instrumento está formado por 20 ítems que se dividen en dos subescalas:

1. Empatía cognitiva: esta subescala mide la capacidad de comprender y tomar la perspectiva de otra persona, incluido el reconocimiento y la comprensión de sus emociones.

2. Empatía afectiva: esta subescala evalúa la capacidad de experimentar emociones en respuesta a los estados emocionales de los demás y de verse afectado emocionalmente por sus experiencias.

Los participantes califican cada elemento en una escala de Likert de 5 puntos en función de qué tan bien la declaración describe sus sentimientos o pensamientos. Las puntuaciones más altas indican un mayor nivel de empatía. La puntuación global es la suma de las puntuaciones de cada ítem.

Empathy Quotient (EQ) [Adult version of Baron-Cohen et al. (2004); Adolescent version of Auyenung et al. (2012); Child version of Auyeung et al. (2009)]

La versión para adultos consta de 60 ítems, 40 de empatía y 20 de control. En cada ítem de empatía, una persona puede puntuar 2, 1 o 0, por lo que el EQ tiene una puntuación máxima de 80 y una mínima de cero. La versión para niños y adolescentes tiene 55 y 40 ítems respectivamente. En ambas versiones, se pide a los padres que indiquen en qué medida están de acuerdo con cada afirmación sobre su hijo marcando una de las cuatro opciones: "totalmente de acuerdo", "ligeramente de acuerdo", "ligeramente en desacuerdo" o "totalmente en desacuerdo". Cada uno de los ítems puntúa con 1 punto si el encuestado informa del comportamiento ligeramente, o con 2 puntos si el encuestado informa del comportamiento fuertemente. Para evitar sesgos en las respuestas, aproximadamente la mitad de los ítems se redactaron para obtener una respuesta "en desacuerdo" y la otra mitad para obtener una respuesta

"de acuerdo". Las puntuaciones más altas indican un mayor nivel de empatía. La puntuación global es la suma de las puntuaciones de cada ítem.

Questionnaire of Cognitive and Affective Empathy (QCAE) (Reniers et al., 2011)

El QCAE consta de 34 ítems que se dividen en cuatro subescalas:

1. Empatía Cognitiva hacia los Otros: Esta subescala mide la capacidad de entender y comprender los sentimientos y pensamientos de los demás.
2. Empatía Emocional hacia los Otros: Esta subescala evalúa la capacidad de experimentar emociones similares a las de los demás, sintiendo lo que otros sienten.
3. Empatía Cognitiva hacia Uno Mismo: Esta subescala refleja la capacidad de entender y comprender los propios sentimientos y pensamientos.
4. Empatía Emocional hacia Uno Mismo: Esta subescala evalúa la capacidad de experimentar emociones similares a las propias, comprendiendo y sintiendo las propias emociones.

Cada ítem del cuestionario presenta una declaración, y los participantes deben indicar en qué medida están de acuerdo o en desacuerdo con cada declaración. Las respuestas proporcionadas por los participantes en las diferentes subescalas permiten evaluar su nivel de empatía cognitiva y afectiva tanto hacia los demás como hacia sí mismos.

Toronto Empathy Questionnaire (TEQ) (Spreng et al., 2009)

Este cuestionario está formado por 16 ítems que evalúan tres dimensiones de la empatía: 1) empatía cognitiva, 2) empatía emocional y 3) habilidades sociales. En su realización, se pide a los participantes que califique qué tan bien los describe cada ítem de la escala. Las opciones de respuesta son: 0 nunca, 1 raramente, 3 alguna vez, 4 a menudo y 5 siempre. Las puntuaciones más altas indican un mayor nivel de empatía. La puntuación global es la suma de las puntuaciones de cada ítem.

2.1.5 Evaluación mediante instrumentos que evalúan la Cognición Social en su totalidad

The Awareness of Social Inference Test (TASIT) (Mcdonald et al., 2007)

El TASIT evalúa la CS en global a partir de los 16 años. Está formada por vídeos con conversaciones cotidianas entre personajes. La tarea del participante consiste en identificar y diferenciar los pensamientos, intenciones y sentimientos de estos personajes a lo largo de las interacciones. Para lograrlo, el participante debe ser capaz de distinguir entre los comentarios literales y no literales presentes en las conversaciones.

Los comentarios literales son aquellos que se expresan y transmiten la información explícita de manera clara. Los comentarios no literales son aquellos en los que el significado completo no se presenta de manera directa y explícita en las palabras utilizadas. Estos pueden incluir la ironía, el sarcasmo y otros tipos de expresiones que requieren una comprensión más profunda y contextual. El test se divide en tres partes:

1. La Prueba de Evaluación de Emociones: Esta parte evalúa la capacidad de reconocer emociones básicas transmitidas a través de expresiones faciales, tono de voz y contexto.

2. La Prueba de Inferencia Social (Mínima): Esta sección se centra en la capacidad de inferir sarcasmo, mentiras y otras señales sociales complejas en situaciones con información contextual mínima.

3. La prueba de inferencia social enriquecida: En esta parte se plantean situaciones más complejas con información contextual más rica, lo que requiere que la persona que realiza la prueba haga inferencias sobre los estados mentales y las intenciones de los personajes.

El tiempo de administración de las Partes 1-3 es de aproximadamente 60 minutos. También existe una versión corta del TASIT de 20 minutos de duración (TASIT-S). La puntuación global es la suma de aciertos obtenidos en cada vídeo.

2.2 Instrumentos utilizados en personas con Daño Cerebral Adquirido

Uno de los principales objetivos de la rehabilitación neuropsicológica tras un DCA es restaurar y/o desarrollar las habilidades de carácter social con el propósito de que la persona logre una mejor vinculación con la familia, redes de apoyo y poder reinsertarse socialmente. Para determinar el punto de partida o grado de desarrollo de la CS es fundamental llevar a cabo previamente una evaluación adecuada (Loubat et al., 2019). Actualmente, la mayoría de los instrumentos disponibles fueron creados con el objetivo de evaluar a personas con autismo, esquizofrenia y/o TDAH, por lo que los instrumentos específicamente diseñados o validados para evaluar a personas con DCA son escasos (Kelly et al., 2017). En la validación debe tenerse en cuenta que, además de la influencia cultural que ocurre con la mayoría de los instrumentos de evaluación cognitiva, en el caso de la CS, la cultura juega un papel muy determinante en el desarrollo, contenido y forma de los componentes de la misma, como las reglas que rigen las dinámicas sociales, los dobles sentidos o la ironía que permiten que la persona tenga una ToM de los demás, o la demostración esperable de la empatía (Koelkebeck et al., 2017; Wellman et al., 2006). Por tanto, los instrumentos deben adaptarse y validarse para las diferentes poblaciones y culturas.

En el análisis llevado a cabo por Wallis et al. (2022), que abarcó 367 documentos que involucraban a 10.930 participantes con DCA, se observó que los dominios más frecuentemente evaluados de la CS eran el procesamiento emocional y la ToM y se destacó la limitada disponibilidad de instrumentos específicos validados para esta población. Entre los instrumentos más utilizados en esta población destacan el Pictures of Facial Affect (Ekman & Friesen, 1976), el Faux Pas Tast (Stone et al., 1998), la parte 2 del TASIT (empleada para evaluar la ToM) (Mcdonald et al., 2007) y el Interpersonal Reactivity Index (IRI) (Davis, 1996). No obstante, los autores señalaron que, a pesar de la utilización de estas herramientas en la población con DCA, existe una necesidad imperante de crear baremos y llevar a cabo la validación adecuada de estos instrumentos específicamente adaptados para las personas con DCA.

En esta misma línea, On et al. (2022) publicó un metaanálisis centrándose en el desarrollo de la CS en la infancia tras haber sufrido un traumatismo cerebral. El estudio señaló que el componente más examinado de la CS en la infancia es ToM y resaltó la necesidad de realizar más investigaciones utilizando instrumentos bien validados y estandarizados, con el fin de disponer de herramientas homogéneas que permitan comparar los resultados entre diversos estudios. Al analizar estos resultados, no se debe pasar por alto el papel relevante que desempeña la cultura en el desarrollo de la CS (Koelkebeck et al., 2017; Wellman et al., 2006), por lo que es importante que cada instrumento esté adaptado y cuente con instrumentos específicos para cada cultura.

En la actualidad, la investigación en CS tiene que hacer frente a varios retos. A nivel global, en lo que respecta a la evaluación en el contexto del DCA, la falta de herramientas validadas limita tanto la evaluación como la rehabilitación de estas capacidades, lo que a su vez restringe nuestra comprensión sobre cómo el DCA afecta a las habilidades sociales de las personas (Kelly et al., 2017). En el contexto específico de España, se destaca la escasez de instrumentos específicamente validados para evaluar la CS en la población general (concretado en el desarrollo de cada instrumento), lo que dificulta la realización de estudios precisos y contextualizados en este ámbito.

En conclusión, existen diversos instrumentos diseñados para evaluar la CS y sus componentes. Sin embargo, en lo que respecta a herramientas especialmente diseñadas para evaluar la CS en personas con DCA, su disponibilidad es limitada, lo que subraya la necesidad de investigar más en profundidad en este campo. En el contexto de España, esta insuficiencia de instrumentos específicos no solo repercute en la población afectada por DCA, sino que se extiende a otros grupos poblacionales. Por tanto, es fundamental llevar a cabo una validación más exhaustiva de las herramientas que permitan una evaluación completa y detallada de la CS y sus diversos componentes.

"Me llamo Máximo Décimo Meridio, comandante de los ejércitos del norte. General de las Legiones Phoenix. Leal servidor del verdadero emperador Marco Aurelio. Padre de un hijo asesinado, marido de una mujer asesinada... y alcanzaré mi venganza en esta vida o en la otra."

Gladiator

3

INTRODUCCIÓN. Programas de entrenamiento de la Cognición Social en personas con Daño Cerebral Adquirido

Como se ha mencionado anteriormente, la Cognición Social (CS) es la capacidad que permite las interacciones y la integración social de la persona (McDonald & Genova, 2021). Numerosos trastornos o dificultades en el aprendizaje conllevan una disminución en esta capacidad (Corrigan & Nelson, 1998; Pavlova et al., 2017; Wearne et al., 2021). Uno de los desafíos centrales en el ámbito de la rehabilitación es fomentar y/o restaurar el desarrollo de la CS, con el objetivo de permitir que la persona comprenda y participe plenamente en el entorno social que la rodea (Cassel et al., 2016).

Table 3.1 Programas de rehabilitación de la Cognición Social I.

Dirigidos a personas con esquizofrenia
Training of Affect Recognition (TAR) (Frommann et al., 2003)
Emotion Management Training (EMT) (Hodel et al., 2004)
Metacognitive and social cognition training (MSCT) (Hogarty et al., 2004)
Social cognition and Interaction Training (SCIT) (Penn et al., 2005)
Metacognitive Training (MCT) (Moritz & Woodward, 2007)
Micro Expression Training Tool (METT) (Russell et al., 2008)
Social Cognitive Skill Training (SCST) (Horan et al., 2009)
Emotion and Theory of Mind Imitation Training (Mazza et al., 2010)
Mind Reading: An Interactive Guide to Emotions (MRIGE) (Lindenmayer et al., 2013)
SocialVille (Nahum et al., 2014)

Para conseguir tal fin, es necesario el diseño de programas de rehabilitación que permitan la estimulación de todos los componentes de la CS (Loubat et al., 2019). Actualmente, la mayoría de los programas de rehabilitación que se han diseñado para la mejora de la CS están dirigidos a personas con esquizofrenia, siendo muy escasos los programas dirigidos a personas con daño cerebral adquirido (DCA). Además, debido a la influencia que la cultura juega en el desarrollo de la CS (Wellman et al., 2006; Wellman & Liu, 2004) es necesario que los programas de entrenamiento se adapten a las características culturales de cada población.

Con el propósito de identificar los programas de rehabilitación, enfocados en uno o varios aspectos de la CS, se ha llevado a cabo una revisión de la literatura. Las Tablas 3.1 y 3.2 presentan una enumeración de dichos programas de rehabilitación, acompañada de la especificación de la población a la que van dirigidos. A continuación, los programas se clasifican en función del componente de la CS al que se dirigen y se presentan algunas de las características más notables de cada uno de ellos.

Table 3.2 Programas de rehabilitación de la Cognición Social II.

Dirigidos a personas con daño cerebral
Emotion recognition training (Neumann et al., 2015)
Reading a Smile (and other emotions) (Bornhofen & McDonald, 2010)
E-motional Training (Vázquez-Campo et al., 2016)
Treatment for Impairments in Social Cognition and Emotions Regulations (T-ScEmo) (Westerhof-Evers et al., 2017)
Computerized social cognitive training (Rodriguez-Rajo et al., 2022)

3.1 Programas de entrenamiento dirigidos al Procesamiento Emocional

El procesamiento emocional ha sido el componente principal de la CS al que se han orientado la mayoría de los programas de rehabilitación. Siguiendo el modelo explicativo de la CS propuesto por Oscher (2008), que sostiene que los componentes de la CS se adquieren de manera jerárquica, tiene sentido priorizar el trabajo en el procesamiento emocional. Según este modelo, este componente es el primero en desarrollarse y sienta las bases para la adquisición de otros elementos como el conocimiento social, la teoría de la mente (ToM) o la empatía.

La relevancia de este componente se hace evidente al analizar los quince programas de rehabilitación mencionados, donde se destaca que todos ellos incorporan ejercicios orientados a este aspecto. De manera destacada, seis de estos programas se centran exclusivamente en el procesamiento emocional: Training of Affect Recognition (TAR) (Frommann et al., 2003), Emotion Management Training (EMT) (Hodel et al., 2004), Micro Expression Training Tool (METT) (Russell et al., 2008), Reading a Smile (and other emotions) (Bornhofen & McDonald, 2010), Mind Reading: An Interactive Guide to Emotions (MRIGE) (Lindenmayer et al., 2013) y Emotion recognition training (Neumann et al., 2015).

De los programas que se centran exclusivamente en la rehabilitación del procesamiento emocional, destaca especialmente el programa "Reading a Smile (and other emotions)" (Bornhofen & McDonald, 2010). Este programa consta de 16 sesiones,

cada una de 90 minutos de duración, lo que lo convierte en el programa más extenso dedicado a abordar las deficiencias en el procesamiento emocional. Seguidamente, el programa de mayor duración destinado a tratar esta deficiencia es el "Emotion Management Training" (EMT) (Hodel et al., 2004), que consta de 24 sesiones, cada una con una duración de 45 minutos.

El programa "Reading a Smile (and other emotions)" (Bornhofen & McDonald, 2010) se estructura en 13 unidades organizadas según el nivel de complejidad. Las Unidades 1 y 2 establecen el contenido y la estructura del programa, incluyendo formato, fundamentos, vocabulario y pautas para los terapeutas. Las Unidades 3 a 9 se centran en aspectos fundamentales de la percepción emocional utilizando señales situacionales, faciales, prosódicas y gestuales, progresando desde material estático hasta estímulos dinámicos y multimodales. Las Unidades 10 a 13 ofrecen un entrenamiento avanzado en el uso de señales emocionales para interpretar comportamientos en interacciones sociales. El manual se complementa con una variedad de estímulos, como tableros de juego y paquetes de cartas que representan expresiones faciales, así como ejemplos en formato de video y audio para mejorar el entrenamiento.

El programa "Emotion Management Training" (EMT) (Hodel et al., 2004) se divide en tres bloques. El primero se enfoca en abordar las deficiencias en la percepción de emociones mediante una evaluación gradual de la expresión propia y de los demás. En el segundo bloque, se trabajan las estrategias de afrontamiento emocional. El tercer bloque se dedica a proporcionar estrategias para mejorar la adaptación social y responder de manera apropiada en diversas situaciones.

Ambos programas de rehabilitación están diseñados para llevarlos a cabo en grupos pequeños y se implementan de manera presencial. El "Reading a Smile (and other emotions)" (Bornhofen & McDonald, 2010) fue diseñado para personas con DCA, mientras que el "Emotion Management Training" (EMT) (Hodel et al., 2004) estaba dirigido a personas con esquizofrenia.

Al examinar los demás programas, cabe destacar que, de los cuatro restantes centrados exclusivamente en la rehabilitación del procesamiento emocional, tres fueron diseñados para su aplicación en personas con esquizofrenia, y solamente uno fue diseñado para personas con DCA: el "Emotion recognition training" (Neumann et al., 2015). De los programas diseñados para personas con esquizofrenia, es relevante destacar que todos constan de 12 sesiones con una duración entre 1h o 45min cada

una. De ellos, el programa que ha sido ampliamente utilizado en investigaciones es el "Training of Affect Recognition" (TAR) (Frommann et al., 2003; Sachs et al., 2012; Wölwer et al., 2005). Este programa se distingue porque se divide en tres bloques, con cuatro sesiones por bloque, abordando la comprensión de las emociones básicas y sus componentes mímicos, la interpretación de expresiones faciales ambiguas y no prototípicas, así como el uso de estrategias para expresar emociones alternativas según sea necesario.

En relación al programa diseñado para personas con DCA, el "Emotion recognition training" (Neumann et al., 2015), cabe mencionar que tiene una duración de 9 horas y que está diseñado para implementarlo de forma online. Este programa está centrado exclusivamente en mejorar el reconocimiento facial, por lo que no aborda otros aspectos esenciales del procesamiento emocional, como el reconocimiento de las emociones a través de la voz (Carter et al., 2009).

Por último, en relación con la cultura, cabe destacar que ninguno de los programas mencionados ha sido adaptado a la población española, por lo que es necesario la creación de programas de entrenamiento que aborden las diferencias culturales de esta población.

3.2 Programas de entrenamiento dirigidos a la Teoría de la Mente

La ToM es reconocida como uno de los componentes fundamentales de la CS (McDonald & Cassel, 2017). De acuerdo con el modelo de desarrollo de la CS propuesto por McDonald (2013), el proceso de adquirir este componente difiere de los otros, lo que implica la necesidad de utilizar estrategias distintas en su entrenamiento.

De los quince programas analizados, únicamente uno se dedica de manera exclusiva a la rehabilitación de este componente de la CS: el "Metacognitive Training" (MCT) (Moritz & Woodward, 2007). Este programa se caracteriza porque fue diseñado para aplicarlo a personas con esquizofrenia y está formado por 8 sesiones, cada una con una duración de una hora. A lo largo de estas sesiones, los participantes aprenden a reconocer las atribuciones internas propias, a comprender

que sus creencias no necesariamente tienen que coincidir con las de los demás, y a comprender la perspectiva de los otros.

Es importante resaltar que el tratamiento se ofrece de forma gratuita y está accesible en diferentes idiomas (37 idiomas) en el siguiente enlace: https://clinical-neuropsychology.de/metacognitive_training-psychosis/. Además, en el sitio web, junto a los enlaces de los materiales, se encuentra información adicional como consejos para la correcta implementación del MCT o acceso a los resultados obtenidos en diferentes investigaciones.

3.3 Programas de entrenamiento que engloban varios componentes de la Cognición Social

La CS es una habilidad compleja que abarca diversos componentes, lo que implica que su rehabilitación debe abordar un trabajo específico que englobe todas las capacidades que la constituyen (Cassel et al., 2016). En contraste con los programas de rehabilitación previamente mencionados, el resto de programas que aparecen en las tablas 3.1 y 3.2 trabajan, de manera simultánea, más de un componente de la CS. Entre estos programas destacan el "Social cognition and Interaction Training" (SCIT) (Penn et al., 2005) y el "Treatment for Impairments in Social Cognition and Emotions Regulations" (T-ScEmo) (Westerhof-Evers et al., 2017) por ser los programas de rehabilitación que trabajan de forma integral más componentes de la CS. El SCIT consta de 24 sesiones de una hora de duración cada una, mientras que el T-ScEmo comprende 20 sesiones de una hora cada una.

El SCIT, que fue diseñado para personas con esquizofrenia, se implementa mediante sesiones grupales en las cuales los participantes se involucran en una serie de actividades y ejercicios diseñados para mejorar su capacidad para comprender y responder de manera adecuada a las señales sociales. El programa se compone de 24 sesiones que se dividen en tres módulos distintos.

El primer módulo se centra en que la persona comprenda qué es la CS y todos los componentes que la conforman. A lo largo de estas sesiones los participantes adquieren conciencia de cómo el deterioro en esta capacidad puede afectar o está afectado a sus interacciones sociales.

El segundo módulo trabaja tres aspectos fundamentales en el desarrollo de la CS. En primer lugar, se pone énfasis en la identificación y comprensión tanto de las propias emociones como de las emociones de los demás. En segundo lugar, se profundiza en la comprensión de las normas sociales que guían cada situación. Por último, se destaca la noción de que los deseos y necesidades personales no siempre coinciden con los de los demás.

El tercer módulo tiene como objetivo permitir a los participantes generalizar la información adquirida en los módulos anteriores y aplicarla en situaciones de la vida cotidiana. En esta fase, los participantes son alentados a recordar situaciones problemáticas y, luego, a aplicar las habilidades aprendidas para identificar los sentimientos de los demás y responder en consecuencia, siguiendo las normas sociales básicas.

Por otro lado, el T-ScEmo se caracteriza porque fue diseñado para aplicarlo en personas con DCA y se compone de 20 sesiones de una hora de duración cada una. En este programa se trabajan tres componentes específicos de la CS: el procesamiento emocional, el conocimiento social y la empatía. A continuación, se detalla las características de cada una de las secciones.

1. Procesamiento emocional: esta sección se enfoca en el reconocimiento y comprensión de las emociones, tanto las personales como las de los demás. Esto implica aprender a interpretar señales emocionales que no son verbales, como las expresiones faciales y el lenguaje corporal. Además, se desarrollan habilidades para regular las emociones y manejarlas de manera productiva. Esto puede involucrar la adquisición de técnicas para enfrentar situaciones, métodos de relajación y enfoques para transformar las emociones negativas.

2. Conocimiento social: esta sección se enfoca en mejorar la interpretación de las señales sociales y en entender las normas sociales que rigen las interacciones.

3. Empatía: esta sección se enfoca en mejorar la capacidad de comprender y responder a las emociones de los demás, fomentando la empatía y las habilidades de toma de perspectiva.

Por último, es importante mencionar que ninguno de los programas previamente citados (SCIT y T-ScEmo) ha sido adaptado específicamente para su uso en la

población española. No obstante, en el análisis llevado a cabo se han identificado dos programas que abordan varios componentes de la CS y que han sido diseñados para personas en España. Estos programas son el "E-motional Training" (Vázquez-Campo et al., 2016) y el "Computerized social cognitive training" (Rodriguez-Rajo et al., 2022).

3.4 Programas de entrenamiento que engloban varios componentes de la Cognición Social diseñados para población española

Después de la evaluación de los diversos programas de rehabilitación, únicamente se han identificado dos propuestas que abordan múltiples componentes CS y que han sido específicamente concebidos para la población española: el "E-motional Training" (Vázquez-Campo et al., 2016) y el "Computerized social cognitive training" (Rodríguez-Rajo et al., 2022).

El programa "E-motional Training" (Vázquez-Campo et al., 2016) se caracteriza por ser un programa de rehabilitación online diseñado para personas con esquizofrenia que tiene una duración de 12 horas distribuidas en dos módulos. El primer módulo se titula “Emociones” donde el paciente comienza con una evaluación pre sobre el reconocimiento de expresiones emocionales faciales. Posteriormente, avanza hacia la fase de entrenamiento, la cual está subdividida en dos tipos: estático y dinámico. Este proceso progresa desde tareas más simples y parciales hasta desafíos más complejos, utilizando vídeos como base de entrenamiento. Una vez concluida la fase de entrenamiento, se vuelve a evaluar al participante utilizando el mismo test inicial para verificar las mejoras obtenidas.

El segundo módulo se titula “¿La fiesta?”. Este módulo se compone de un cortometraje de dibujos titulado “¿la fiesta?, con una duración de 30 minutos. El argumento del corto gira en torno a un grupo de jóvenes treintañeros que se reúnen, con el propósito de facilitar la identificación por parte del usuario de las situaciones expuestas. El cortometraje está compuesto por 33 escenas breves, en las cuales se presentan situaciones de malentendidos, comentarios irónicos, meteduras de pata, metáforas y otros elementos similares. Posterior a la visualización del vídeo, se

proporciona una serie de preguntas que abarcan aspectos tanto de control como de evaluación de los diversos componentes del procesamiento cognitivo-social que están siendo abordados en el programa.

Por otro lado, el programa "Computerized social cognitive training" (Rodriguez-Rajo et al., 2022) fue diseñado para ser implantando con persona con DCA. Se caracteriza por estar formado por un total de 21 sesiones y por aplicarse de forma online. El programa se organiza en dos módulos bien diferenciados. El primero, enfocado en el tratamiento de la cognición no social, aborda aspectos clave como la estimulación y el tratamiento de la atención, la memoria y las funciones ejecutivas. Por otro lado, el segundo módulo se centra en la CS. En este caso, el programa aborda una serie de desafíos cognitivos que involucran sesgos cognitivos, el procesamiento emocional y la ToM. Para lograr esto, el programa hace uso de herramientas visuales como fotografías y videos, lo que permite a los participantes interactuar con situaciones de la vida real y desafíos emocionales en un entorno controlado. Sin embargo, los resultados de este programa reflejan que es efectivo para mejorar la ToM, pero no el procesamiento emocional ni el resto de componentes de la CS.

En resumen, se puede concluir que la disponibilidad de programas de rehabilitación que aborden todos los aspectos de la CS es bastante limitada. Esta carencia es aún más pronunciada en el contexto español, donde únicamente se han identificado dos programas que consideran las particularidades culturales de esta población. Es importante destacar que, a pesar de que uno de estos programas está diseñado específicamente para personas con DCA, su efectividad se ha evidenciado solo en la mejora de la ToM. Estos hallazgos subrayan la necesidad urgente de desarrollar más programas de rehabilitación que no solo tengan en cuenta las peculiaridades culturales, sino que también estén dirigidos a personas con DCA, abordando de manera integral los diversos aspectos de la CS.

"Eres más valiente de lo que crees,
más fuerte de lo que pareces y más
inteligente de lo que piensas."

Winnie the Pooh

4

Justificación, objetivos e hipótesis

4.1 Justificación y objetivo general

Como se ha mencionado en el primer capítulo, la Cognición Social (CS) es la capacidad que posibilita una integración social efectiva y permite a las personas desenvolverse de manera satisfactoria en el entorno social (McDonald & Genova, 2021). La integración social se logra gracias a la comprensión de las normas sociales y las dinámicas de grupo, así como mediante la intervención de los otros componentes de la CS, como el procesamiento emocional, Teoría de la Mente (ToM) y la empatía (Cassel et al., 2016), todos ellos elementos cruciales para una participación exitosa en la vida comunitaria (Fiske & Taylor, 2008). Cuando la CS no se ha desarrollado correctamente o se ha deteriorado, las personas presentarán dificultades características que incluyen déficits para interpretar de manera precisa las emociones propias y

ajenas, para comprender y utilizar de manera adecuada las señales sociales, para discernir las intenciones de los demás y para ajustar su conducta a las demandas sociales de cada situación (Smith & Semin, 2007). Estas disfunciones provocan una limitación para establecer y mantener amistades y relaciones significativas, lo que conllevará una exclusión parcial o completa del entramado social (Spikman et al., 2012). Además, la falta de comprensión de las dinámicas interpersonales y la percepción de aislamiento social se asocian con un mayor riesgo de desarrollar otros trastornos como ansiedad o depresión (Kuiper & Higgins, 1985). Con frecuencia, la CS se encuentra afectada como consecuencia de un daño cerebral adquirido (DCA). Wallis et al. (2022) evidenciaron que al menos uno de los déficits mencionados anteriormente está presente en el 83.11 % de los estudios que habían examinado la CS en personas con DCA, y Adams et al. (2019) revelaron en un meta-análisis que tras un ictus las personas suelen presentar déficit en ToM, conocimiento social y procesamiento emocional, tres de los cuatro dominios principales de la CS. El 84 % de los terapeutas corroboran que más de la mitad de sus pacientes con DCA presentaban deficiencias en CS, sin embargo, el 78 % de ellos nunca o con poca frecuencia las evaluaban, aludiendo a la escasez de pruebas fiables para ello (Kelly et al., 2017). En consecuencia, los expertos proclaman que sigue siendo necesario llevar a cabo actuaciones que incorporen la CS en la evaluación del DCA y también en la rehabilitación (Sirois et al., 2019).

Tradicionalmente, la detección de las deficiencias en CS en personas con DCA se ha basado en la información de la entrevista clínica y en la extrapolada de pruebas neuropsicológicas generales (McDonald & Flanagan, 2004), dificultándose la identificación precisa de cuáles son los componentes específicamente alterados (Spikman et al., 2012). Son escasos los instrumentos diseñados para personas con DCA (Tousignant et al., 2018), la mayoría fueron diseñados para personas con autismo o esquizofrenia (Wallis et al., 2022), por lo que el desarrollo y validación de instrumentos estandarizados es crucial para llevar a cabo una evaluación adecuada de los distintos componentes de la CS. Además, dada la influencia relevante que ejerce la cultura en el desarrollo de componentes de la CS como la ToM (Koelkebeck et al., 2017), los instrumentos específicos para su evaluación deben ser adaptados para las diferentes poblaciones y contextos culturales (Wellman et al., 2006). En la actualidad, contamos con varias herramientas validadas para evaluar la ToM en

población española como las "Stories of Everyday Life" de Kaland et al. (2002) para niños y adolescentes entre 7 y 15 años, adaptada por Lera-Miguel et al. (2016) o la "Movie for the Assessment of Social Cognition" (MASC) de Dziobek et al. (2006) partir de los 16 años, adaptada por Lahera et al. (2014). Esta situación deja una carencia de instrumentos de evaluación dirigidos a la población infantil española entre la edad de inicio de adquisición de los componentes identificables de la ToM a los 3 años, hasta los 7 años.

Respecto a la rehabilitación de la CS en personas con DCA, apenas se están empezando a aplicar a nivel mundial y los programas con eficacia publicada que se dirigen específicamente a esta población son muy escasos (Cassel et al., 2016).

Además, destaca que, a pesar de que se ha mostrado que en muchas personas con DCA se ven afectados casi todos los componentes de la CS (Adams et al., 2019), la mayoría de los programas intervienen sólo en uno o dos de sus componentes, siendo el procesamiento emocional y/o la ToM los más comunes (Roelofs et al., 2017).

Por otro lado, de acuerdo con el análisis realizado por Vallat-Azouvi et al. (2019), uno de los retos fundamentales en la investigación sobre la rehabilitación de la CS en personas con traumatismo craneal consiste en la urgente tarea de diseñar intervenciones que logren la generalización de sus efectos mejorando las aptitudes sociales en el contexto diario de las personas. Este propósito podría cumplirse mediante dos aproximaciones por parte de los programas de rehabilitación. Una primera aproximación consiste en que las actividades del programa de rehabilitación estén dirigidas directamente a mejorar los componentes de la CS, abordando en primer lugar la adquisición de prerrequisitos, como son los conocimientos sobre el propio componente de la CS (por ejemplo, a través de psicoeducación) o los aspectos más básicos sobre los que se apoyan otros de más complejidad (por ejemplo, el reconocimiento de emociones como primer paso para la demostración de empatía). A continuación, el programa incluirá un entrenamiento para que dichos conocimientos adquiridos se puedan traducir en conductas que la persona pueda poner en práctica en su vida y contextos sociales reales (Wilson et., 2009). Una segunda aproximación consiste en abordar directamente el entrenamiento de las conductas objetivo que se han identificado como desadaptativas. En este segundo tipo de programas, la psicoeducación también puede estar presente como un facilitador del cambio, pero el foco está desde un principio puesto en la extinción y el entrenamiento para el

aumento de la frecuencia de conductas o para la adquisición de conductas alternativas. Este tipo de programas son altamente individualizados y los estudios de evidencia en DCA en general se distinguen por seguir frecuentemente la metodología de diseño experimental de caso único (Nahum et al., 2014; Penn et al., 2005) y por estar siendo específicamente utilizados para intervenciones en CS en estos pacientes (Rietdijk et al., 2019; Vassallo & Douglas, 2021). En concreto, el diseño A-B-A' ha demostrado validez en estudios de intervención para mejorar la CS (Peyroux & Franck, 2016), aumentar las habilidades sociales y disminuir comportamientos desafiantes (Binder et al., 2019; Jacobson & Truax, 1992). Teniendo en cuenta los retos actuales que presenta la investigación de la CS tras el DCA, el objetivo general de esta tesis doctoral ha sido aportar herramientas y evidencias de su utilidad para el abordaje de la CS en niños, adolescentes y adultos con DCA.

4.2 Objetivos específicos e hipótesis

La Fig. 4.1 muestra el objetivo general y los objetivos específicos de la Tesis Doctoral.

Primer objetivo específico: Adaptar y validar una escala de evaluación de la ToM (ToMas-Child) para población infantil española de 3 a 7 años (estudio 1).

Hipótesis:

- Se espera que los participantes de más edad dentro del rango de 3 a 7 años obtengan una puntuación más alta.
- Se espera que la cultura afecte al orden de adquisición de los diferentes ítems que conforman la escala.

Segundo objetivo específico: determinar la eficacia de un programa de rehabilitación individualizado diseñado para el abordaje de las conductas desadaptativas de un niño provocadas por déficits en CS tras un traumatismo craneoencefálico aplicando un diseño experimental de caso único (estudio 2).

Hipótesis:

- Se espera que el programa resulte efectivo en la reducción de las conductas problemáticas y el incremento de las conductas socialmente adecuadas.

Tercer objetivo específico: determinar la eficacia de un nuevo programa de rehabilitación (SocialMind) para personas con DCA basado en el aprendizaje de conocimientos y la práctica de actividades de cada uno de los cuatro componentes de la CS (estudio 3).

Hipótesis:

- Se espera que el programa produzca mejoras significativas en todos los componentes de la CS respecto a un grupo control.

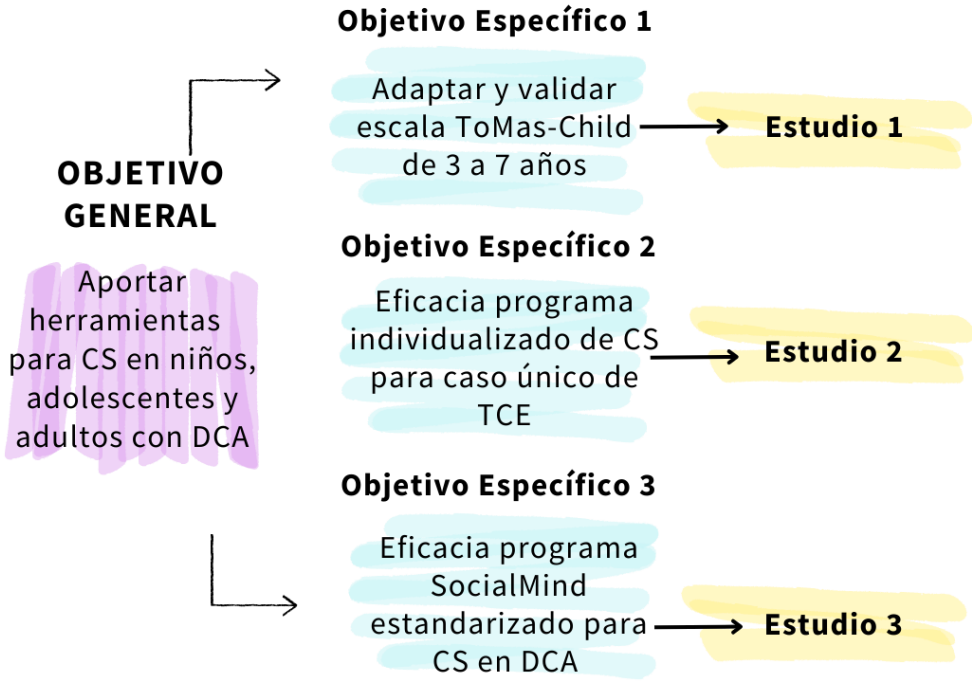

Fig. 4.1 Objetivo general y objetivos específicos de la tesis doctoral.

"Caminante, son tus huellas el camino y nada más; Caminante, no hay camino, se hace camino al andar. Al andar se hace el camino, y al volver la vista atrás se ve la senda que nunca se ha de volver a pisar. Caminante no hay camino sino estelas en la mar."

Antonio Machado

5

EMPIRICAL RESEARCH. Validation of the ToMas-child scale for children aged 3 to 7 year

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5.1 Introduction

The Theory of Mind (ToM) is considered the central component of social cognition and, along with emotional perception and empathy, the most studied (Mcdonald & Cassel, 2017). The ToM is defined as the ability to understand others' mental states (interests, beliefs, emotions and intentions) that allows people to predict others' behavior and to contrast between those states and ones of oneself (Achim et al., 2013). The ToM is also called cognitive empathy or mentalization because it relates to understanding emotions and others' point of view but maintaining a clear distinction regarding oneself (Decety & Jackson, 2004). Lieberman (2007) proposed two main processes in the ToM: (a) recognizing that the minds of others have thoughts and feelings, and (b) development of a theory about how these minds operate and respond to environmental events. Based on these processes, some authors summarize the ToM as a prediction and explanation of behavior based on mental states (Repacholi & Slaughter, 2003).

Many studies place the age of 3 years as the time when attention and social knowledge prerequisites culminate with the appearance of the most basic components of the ToM (Cassel et al., 2016). Between the ages of four and five, neurotypical children develop other increasingly complex components of the ToM such as the understanding of false beliefs (Walz et al., 2009). By far, the most studied milestone of the ToM is that ability to understand false beliefs (Wellman et al., 2001). Around the 4 years old many children are able to predict how a protagonist will behave based on a mistaken belief (Ebert, 2020).

Several factors are associated with ToM development. Language skills are closely related to the ToM (Milligan et al., 2007), In early childhood, pragmatics is the dimension of language most related to the ToM acquisition (Fernández, 2011; Matthews et al., 2018). Pragmatics includes the social, emotional, and communicative aspects of language (Adams et al., 2016). Applying language in communicative exchanges boost achievement of relevant components of ToM such as awareness that people could have different points of view, and use of words referring to mental states (Astington & Baird, 2005). Environmental factors such as family size, peer relationship, and culture have been also related to ToM development (Hughes et al., 2018; Prime et al., 2016). Regarding family size, the number of siblings might

influence ToM acquisition speed because ongoing interactions between them help understanding of connections between thoughts, feelings, and behaviors (Howe et al., 2011). For the same reasons, relationships between peers boost development of ToM in childhood (Vonk et al., 2020). Culture has also shown to be related to the order in which certain ToM milestones are acquired. Wellman et al. (2006) found that Chinese children first gained the ability to understand that other's beliefs may be different from their own, and later the perspective on what others know or ignore. In American children, the order of acquisition of these two components of the ToM was the opposite. Authors argued that this acquisition order was based on cultural features such as individualism versus collectivism. A slow or inadequate development of ToM poses a risk to the social inclusion and academic performance of children (Amsterlaw et al., 2009). Negative effects of a protracted deficit in the acquisition of ToM extend to adolescence and adult life (Repacholi & Slaughter, 2003). The important role of the ToM along the life cycle has placed it into the focus of interest for developmental psychologists. There is a massive amount of studies about individual differences in ToM during childhood. A vast number of studies have examined individual differences in ToM using a wide range of experimental tasks (Aboulafia-Brakha et al., 2011; Molenberghs et al., 2016). However, many studies have focused on measuring just a single ToM component, the understanding of others' false beliefs (O'Connor & Evans, 2019). Beaudoin et al., (2020) found that the most widely used ToM task is the Baron-Cohen et al. (1985) adaptation of the Sally and Anne false belief task (Wimmer & Perner, 1983). In terms of scales for the assessment of ToM, two recent reviews showed that from younger than six years to middle adolescents (Beaudoin et al., 2020; Hayward & Homer, 2017) the Strange Stories Test (Happé, 1994), the Faux Pas Test (Baron-Cohen et al., 1999), and the Hinting Task (Corcoran et al., 1995) were the most commonly applied. Each of these instruments purportedly assesses a single aspect of ToM. However, Zilber (2017) argues that a complete measure of the metacognitive, linguistic, emotional, and social aspects of the ToM is needed. In addition, there can be a lack of transference of the ToM evaluation tasks from research contexts to educational or health settings (Sprung, 2010). Professionals in charge of children in real-world contexts need a larger number of standardized and validated scales to assess the entire spectrum of ToM in children with and without typical development. For this reason, authors of

the current study compiled eight widely applied research tasks to form a standardized scale called the Theory of Mind assessment scale in children (ToMas-child). These eight tasks were compiled trying to cover the entire continuum of the construct in the ToM in children from 3 to 7 years old inclusive (Wellman et al., 2011; Zilber, 2017). All tasks were linguistically and culturally adapted to Spanish speaking children in Spain. The purpose of the current study was to validate this new scale composed of established items previously used with Spanish children.

The Rasch measurement model is recommended over the traditional methods for evaluating scales (Cano & Hobart, 2011). Rasch analysis is becoming increasingly applied to validate assessment instruments (Aryadoust et al., 2019). This analysis addresses essential assumptions of test validity such as unidimensionality, invariance of measurement along the continuum of the construct, and stability of items across groups of respondents (Wright & Stone, 1979). Several Rasch analyses have been previously applied to some of the items compiled to form the ToMas-child scale. Data from different cultural samples of typical development children have been used: 75 Americans (Wellman & Liu, 2004), 92 Chinese (Wellman et al., 2006), 68 British (Hiller et al., 2014), 77 Australians plus 58 Iranians (Shahaeian et al., 2011), and 62 Australians (Peterson et al., 2005). However, findings from those studies have some limitations: sample sizes too small to secure stable results, use of different versions of the items, and reported findings regarding the individual items but no information about overall fit of the scales. Therefore, we concluded that the eight classic items that have been compiled to form the ToMas-child scale must be tested in a new sample to validate them as a proper tool for assessment of the ToM. The aim of the study was to determine the psychometric properties of the items on the Theory of Mind assessment scale in children (ToMas-child) using Rasch analysis in a sample of Spanish speaking children aged from 3 to 7 years old.

5.2 Material and methods

5.2.1 Participants

A sample of 252 children (52 % males) was assessed in seven public schools of the city of Granada in Spain. Criteria to participate were: (a) children attending ordinary

pre-school or primary school; (b) with absence of severe language comprehension problems informed by their school tutors and verified by a BLOC-S-R score above 3; (c) with absence of any neurological or developmental impairment diagnosis informed by their parents; and (d) age between 3 and 7 years. Age criterion of Wellman and Liu (2004) study (3 to 6.5 years) was extended to 7 years inclusive. There was scope to include older children because these authors reported that more than 50 % of the oldest children did not pass all items.

Mean age was 5.43 ranging from 3 to 7.92 years. According to the Spanish educational system, percentage of participants in pre-school education was 9.5 % in the first course, 12 % in the second and 39.9 % in the third. The remaining 38.6 % were in the first course of primary education. 166 (65.9 %) lived with siblings at home.

Children and their parents signed an informed consent. Parents completed a questionnaire about basic socio-demographic data: sex and age of the child, number of siblings living at home, medical problems, and outstanding medical and developmental aspects. The project had been approved by the Ethics Committee of the University of Granada (250/CEIH/2016).

5.2.2 Instruments

The Pragmatic Language subtest of the Battery of Objective and Criteria-Screening Language Revised (BLOC-S-R) (Puyuelo Sanclemente, 2007)

This subtest was applied to control a potential bias due to pragmatic language deficits. The BLOC-S-R consists of six items that evaluate the use of greetings, questions about why and how, farewells, action requirements, attention demands and comments of approval and disapproval. A drawing of the scene and the verbal description of two situations that take place in a veterinarian's office are used. The child is asked to imagine that he/she is one of the characters in the scene and to answer one question about each of the six pragmatic language elements. One point is awarded for each correct answer. Overall score ranges from 0 to 6.

The ToM assessment scale in children (ToMas-child)

The ToMas-child aims to measure the achievement of the main milestones of the development ToM in childhood. The scale is made by arrangement of eight tasks widely used in previous research.

The ToMas-child includes the five items of The ToM Scale (ToM-s) (Wellman & Liu, 2004): Diverse desires (Repacholi & Gopnik, 1997; Wellman & Woolley, 1990), Diverse beliefs (Wellman et al., 1996; Wellman & Bartsch, 1988), Knowledge access (Pillow, 1989; Pratt & Bryant, 1990), False contents belief (Perner et al., 1987), and Hidden emotion-long (Harris et al., 1986). To avoid item naming mistakes, in the first publication of that scale, but only there, the Hidden emotion task was entitled Real-apparent emotion (Wellman & Liu, 2004).

Three more tasks were used to form the ToMas-child scale: Sally-Anne (Baron-Cohen et al., 1985; Wimmer & Perner, 1983), Belief-emotion (Harris et al., 1989; Wellman & Liu, 2004), and a second Hidden emotion-short task (Wellman et al., 2006). As the Sally-Anne task has been applied in nearly 50 % of the studies published to date (Beaudoin et al., 2020), this was included to make research results easily comparable. The belief-emotion task was included due to the essential role that emotion attribution plays in development of the ToM in young children (Rosnay et al., 2004). Finally, a second hidden emotion task was added to the scale for language comprehension purposes. The hidden emotion item already included in the ToM-s of Wellman and Liu (2004) seemed long to the youngest children. As age and language ability together explained 72 % of emotion understanding variance (Pons et al., 2003), a shorter hidden emotion task from Wellman et al., (2006) was added to the scale. To easily differentiate between them, the words -short and -long was added after the title of the two Hidden emotion tasks.

Therefore, the ToMas-child scale is an extension of the ToM-s (Wellman & Liu, 2004) to which three new items were added. Ordering of the items was based on the a priori expected item difficulty according to the literature (Pons et al., 2004; Wellman et al., 2006; Wellman & Liu, 2004). Name of items in the ToMas-child referred to the specific ToM content to be measured by each of the eight tasks: Diverse desires (item #1) , Diverse beliefs (#2), Knowledge access (#3), False Contents belief (#4), Sally-Anne (#5), Belief-emotion (#6), Hidden emotion-short (#7), and Hidden emotion-long (#8).

The adaptation of the ToMas-child tasks for Spanish children was based on Wellman and cols. (Wellman et al., 2006; Wellman & Liu, 2004) and the Sally-Anne task of Baron-Cohen and cols. (1985). Instructions and materials were matched to the culture of Spain. A pilot study was carried out in 15 children aged 3 to 7. It was verified that all children understood instructions and items demands. All materials were familiar to them and correctly recognized.

In all tasks, situations were described verbally and all characters were presented by drawings or dolls. Despite the apparent lack of ecological validity, it has been found that, at least for all false beliefs tasks children give the same answer when asked about real persons, videos, dolls, toys, or drawings (Wellman et al., 2001).

All but the Sally-Anne task had control/memory questions and the target question. One point is awarded when children get the correct answers to both the control and the target questions. Each item is marked with 0 point when the answer to any of the two questions is wrong. A correct response suggests the milestone is achieved.

In order to standardize the ToMas-child scale, detailed instructions have been provided, all materials have been carefully specified and showed in pictures, and a recording sheet has been designed to write down answers to all control/memory/target questions. The complete validated version of the ToMas-child scale in Spanish is available in the supplementary material. For informational purposes, a literal English translation of the Spanish version is also available.

5.2.3 Procedure

The school tutors gave an information letter to the parents specifying the inclusion / exclusion criteria for the children. All 252 children whose parents agreed to participate met the study criteria and were included. Children were tested individually in a quiet room in their schools in a single session of about 25 minutes. After 5 minutes of introduction and habituation to the examiner, the Pragmatic Language subtest of the BLOC-S-R was administered. If the child had no problem in the pragmatic of the language, the items of the ToMas-child were applied.

5.2.4 Analysis

Rasch analysis was conducted to determine unidimensionality and overall fit of the scale to the Rasch model, individual item fit, targeting to the participants, functioning of response categories and the presence of differential item functioning (DIF) by three dichotomic personal factors: sex (male, female); schooling level (pre-school, primary school) and presence of siblings (yes, no). Data from the ToMas-child were evaluated against the Rasch model expectations using the RUMM2020 software (Andrich et al., 2003). Extended information about the protocol for conducting and reporting Rasch analysis can be found elsewhere (Hagquist, Bruce, & Gustavsson, 2009; Tennant & Conaghan, 2007).

The Rasch Model (Rasch, 1980) is a probabilistic model of measurement within the Item Response Theory. Scores are transformed in an interval scale unit of measurement called logit (Tesio, 2003). Rasch analysis calibrated all items according to their difficulty to be achieved; and also the sample according to their level of ability on the latent construct. Construct validity of the scales is determined by examining the hierarchy of the items based on their difficulty as well as by evaluating the fit of each item to the latent construct (Linacre, 2002). The sample size of the study will guarantee at the 99 % confidence the stability of item location estimation (Linacre, 1994).

5.3 Results

A first Rasch analysis was performed for the whole scale. The unrestricted (partial-credit) model was adopted since a likelihood ratio test ($p<.001$) showed the rating scale model was less suitable, due to variable threshold distances across items.

5.3.1 Fit statistics

Results revealed a significant item-trait interaction (see first analysis in Table 5.1) that meant the responses to the scale did not fit the Rasch model. Thereafter, item fit statistics were examined. These statistics assess the residual for each item. Residuals ranging within ± 2.50 and non-significant chi squares are acceptable. We found that item 5 (Sally-Anne) showed misfit due to high negative residual (-3.28) and significant

Table 5.1 Fit statistics, reliability, and unidimensionality indices for the ToMas-child (N = 252).

Analysis number and items included	Item-trait interaction χ^2 (p)	Misfitting items	Ítem fit residual Mean (SD)	Person fit residual Mean (SD)	Person Separation Index PSI	Unidimensionality Independent t-test % with extremes (95% CI)
1) All: 8	78.178 (<.001)	#5 (p=.004)	-.707 (1.39)	-.218 (.79)	N/A	N/A
2) Seven: #5 deleted	43.003 (.003)	#3 (correlation with #2)	-.397 (1.062)	-.267 (.672)	N/A	N/A
3) Six: 1 superitem (#2 + #3) and the remaining 5 items	23.269 (.18)		-.262 (.740)	-.225 (.618)	.70	2.22% (-.015 to .059)

chi-square value (p=.002). This lack of the expected probabilistic relationship between the individual item and other items in the scale indicated that the item 5 does not contribute to the latent trait theory of mind. High negative residuals indicate redundancy of the item. For that reason, item 5 was deleted and a second analysis was run for the remaining seven items.

Secondly, Rasch analysis of the scale also indicated an overall misfit to the model (see second analysis in Table 5.1). On this occasion, all items showed fit residuals. However, there was a high correlation (>0.3) between residuals of items 2 (Diverse beliefs) and 3 (Knowledge access). Correlation above 0.3 is thought to indicate local dependence between answers that occurs when a person's response to one item is reflected in their response to another item (Elder et al., 2017). Local independence of items is an assumption in Rasch model. Local dependency should be avoided because it results in biased parameter estimation and affects the unidimensionality of the scale. The best option is to bundle the items into a polytomous super-item (Baghaei, 2008). Therefore, in the third analysis items 2 and 3 were combined into a super-item.

The last Rasch analysis was conducted using the remaining five items and a combination of items number 2 and 3 in a super-item. After those changes, the scale showed non-significant item-trait interaction that indicated satisfactory fit of the scale to the model (see analysis 3 in Table 5.1). Threshold ordering of the superitem confirmed that category responses of the new item worked as intended.

5.3.2 Differential Item Functioning (DIF)

Rasch analysis uses DIF for checking the equivalence of items across groups of respondents with different categories of relevant factors that might affect the construct (Embretson & Reise, 2000). Analysis showed absence of DIF by sex, schooling level and presence of siblings at home. That implies invariance in latent trait manifestation across the three factors involved (Tennant et al., 2004).

5.3.3 Unidimensionality

Unidimensionality was checked using a Principal Component Analysis of the person residuals. This is the most exigent demonstration of unidimensionality of a test. This method could be consulted elsewhere (Caracuel et al., 2011). The percentage of t-tests outside the CI at 5 % did exceed the criterion of 5 % (Tennant & Conaghan, 2007). Therefore unidimensionality of the subscale and local independence of items can be assumed (Smith, 2000).

5.3.4 Person Separation Index (PSI)

PSI is an estimate of reliability similar to Cronbach's alpha coefficient (Bode et al., 2000). It is based on the number of strata that can be distinguished in the distribution of the sample. PSI value indicates the power of the scale to differentiate people on the measured construct. A value of 0.7 is the lowest acceptable PSI because it is not possible to distinguish between more than two strata of persons separated with 95 % confidence (Fisher, 1992). The ToMas-child has sufficient power to classify children in two levels based on their development of ToM.

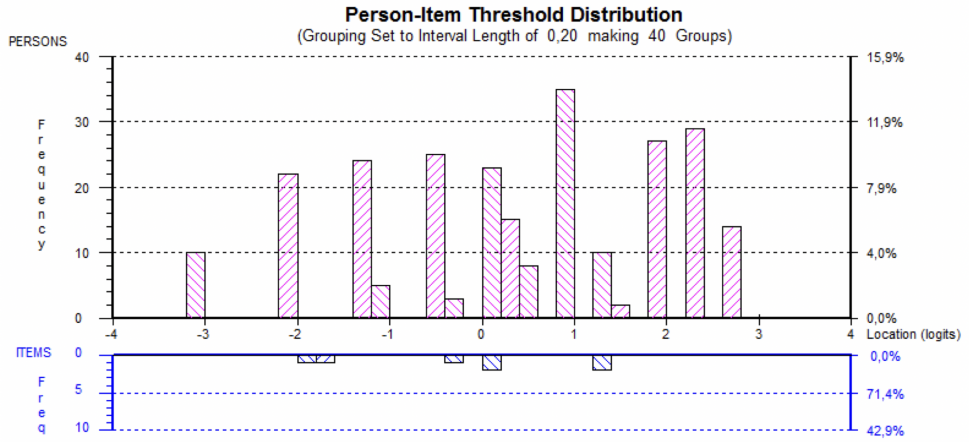

Fig. 5.1 Distribution throughout the construct of the six items of the SaToM-child that fit to the Rasch model (bottom) and participants (top) (N = 252)

5.3.5 Targeting

This refers to the extent to which the items have adequately targeted the level of ToM of the children in the sample. As the mean of items is placed by the analysis at the 0.0 point of the common logit scale, mean person location and standard deviation will indicate the targeting of the scale. Mean person location outcome was 0.271 (SD = 1.703) that indicated the average ToM level of the sample was slightly above the average of ToM reflected by the items. That value is close enough to the zero to state that the targeting was good. A visual inspection of the person-item distribution map (see Fig. 5.1) also indicated the scale was well-targeted.

5.3.6 Item calibration

Rasch analysis makes a calibration of items based on likelihood of correct response. The location order of each item in Table 5.2 indicated its difficulty to be achieved by the children. Inspection of Item Location Order is a way to assess the construct validity of the scale (5.2). A range of 3.4 logits between the location of the easier item (-1.997; Diverse desires) and the most difficult (+1.429; Hidden emotion) is considered wide enough.

Table 5.2 Location order of the items in the ToMas-child

Items (order in the original scale)	Location	Standard Eror	Fit Residual	χ^2 Prob.
Diverse desires (#1)	-1.997	0.268	0.038	0.15
Diverse beliefs and Knowledge access (#2 & #3)	-1.201	0.166	-1.049	0.14
Belief-emotion (#6)	0.144	0.203	0.962	0.71
False contents belief (#4)	0.236	0.203	-0.793	0.14
Hidden emotion-short (#7)	1.390	0.209	-0.027	0.54
Hidden emotion-long (#8)	1.429	0.210	-0.702	0.31
Sally and Anne (#5)	Misfit			

5.4 Discussion

The aim of the study was to determine the psychometric properties of the items on the Theory of Mind assessment scale in children (ToMas-child) using Rasch analysis in a sample of children aged 3 to 7 years. A satisfactory fit to the Rasch model was achieved after deleting misfit item 5 (Sally-Anne) and combining items 2 and 3 in a single item. The overall fit means that the ToMas-child is a unidimensional instrument. All items in the scale assess different components or parts of the continuum of a unique latent construct. Therefore, individual scores from each item can be added to sum a meaningful overall score. Furthermore, as the scale fits to the Rasch model, overall score represents an interval scale measure and can be properly used in parametric analysis (Wright & Masters, 1982).

The Rasch measurement model provides the strictest method to validate the items of an assessment tool (Cano & Hobart, 2011). Findings from the Rasch analysis propose a hierarchical order of achievements of components of the ToM. Calibration based on items difficulty is an evidence-based milestone map about how children of 3 to 7 years old acquire their ToM. Each task in the scale is a potential component of the ToM. Below, these findings are going to be contrasted with previous evidence in typical development to determine the construct validity of the 6-items ToMas-child scale.

The first item on the hierarchy based on the probabilistic difficulty to be achieved is related to diverse desires. This is a mental state about one's own and others' wishes and the notion that these desires will elicit a specific behavior. Analysis shows that this milestone is easy to achieve for most of the children at the age of 3. Just ten children (first left column at the top of Fig. 5.1) were far from the location of the first task (first left column at the bottom of the common scale), that means they did not give the correct answer. This finding is also supported by studies from authors that applied the same task (Wellman et al., 2006; Wellman & Liu, 2004), even for children with hearing impairment and autism (Peterson et al., 2005).

Findings indicate that the next milestone in the ToM latent construct is composed by two related components. Results have indicated that item 2 (diverse beliefs) and 3 (knowledge access) were interdependent, and then we joined them as two parts of a single super-item. Maybe this dependency is because they have exactly the same prerequisites or, at least, they share some underlying processes. The first component of this new proposed mental state is about one's own and others' beliefs in a specific context where beliefs are not based on evidence or facts. The second component is the understanding of the ignorance of other person when only the child has access to evidence. A common feature of these two interdependent tasks is that for passing them the child need awareness of other people's having lack of evidence. A series of studies found that for American and Australian children, diverse beliefs (item 2) was the second easiest milestone, whereas knowledge access (item 3) was the third. However, for Chinese and Iranian children the order was exactly reverse (Shahaeian et al., 2011; Wellman et al., 2006; Wellman & Liu, 2004). Following our findings, we propose that both, beliefs and access to knowledge, are so interdependent that they are parts of a composite mental state or milestone. This lack of independency might be a contributing factor to the reversed and elusive order that some authors have been finding diverse beliefs and access to knowledge in culturally different samples. Knowledge and beliefs can be right or wrong; in contrast to the first milestone that is related to desires which do not have a truth status and just could be fulfilled or not (Miller, 2012). Both tasks joined in the second milestone share some requirements (right status) and these processes seem to be more demanding than those connected with desires (fulfillment status). Then, there is evidence that support our findings that diverse beliefs and access to knowledge are hierarchical components of the ToM

that are acquired after the awareness of the diversity between one's own and others' desires (item 1) (Shahaeian et at., 2011; Wellman et al., 2006; Wellman & Liu, 2004). Following the location order of the items after the Rasch analysis, the third milestone in the hierarchy is called belief-emotion. An emotion arises after a belief (prediction of the content due to the familiarity with the container). But after seeing that the content is not expected, the emotion changes. Children have to predict the negative emotion resulting from the false belief. Our findings indicate this task is located on the middle of the continuum of the latent trait (location 0,144). Then, its difficulty is moderate. Unlike in our study, Wellman & Liu (2004) found that belief-emotion had similar difficulty in the hierarchy than false contents belief and explicit false belief. They considered that the three items represent similar constructs and just retained the false contents belief task in their scale. Then, as far as we know, this is the first time that this milestone has been placed in the central position of the hierarchy of acquisition of the ToM in children. The mental status that represents this milestone requires that the child had achieved the understanding of others' beliefs (Rosnay, Pons, Harris, & Morrell, 2004), that is part of the previous item in our hierarchy. That intermediate position is also supported by Davis (2001) who demonstrated that understanding of what one person beliefs about another person's emotions is not a type of second-order belief. Some evidence also places the acquisition of the belief-emotion ability in a middle point of our sample range of age. Between the age of 4 and 6 years children start to understand that beliefs determine emotional reactions (Pons et al., 2004). Only 52 % of children between 3 and 6.5 years passed this task (Wellman & Liu, 2004). However, 100 % of children between 6 and 13 years showed a full achievement of this ability (Bakhshipour et al., 2012).

The fourth milestone is the contents false belief, a mental status that emerges to the fact that the contents of a container does not correspond to what it apparently should contain. Like in the Wellman and Liu (2004) study, Rasch analysis placed this item in the middle of the hierarchy but it is a bit more difficult than the previous one (location 0,236). Davis (2001) found that false belief knowledge and representational change knowledge develop concurrently in the affective and physical domains. Then, we consider that the previous milestone (belief-emotion) and this (contents false belief) are two aspects of the ToM that develop in parallel and that is why they occupy such a close position in the hierarchy. However, both tasks provide different

information on the construct and both deserve to be kept on the scale. Although these two tasks have similar structure, the presence of an emotional component on the belief-emotion task is a relevant difference between them. Maybe the experience of children with their own emotional states gives them an advantage to understand belief-emotion tasks a bit easier and earlier than contents false belief tasks when the latter are free of emocional activation (Rosnay et al., 2004).

Short and long hidden emotion tasks placed the last locations of milestones on the developmental hierarchy. The fifth was the hidden emotion short task. This item is about understanding that to not hurting loved ones' feelings, it might be necessary to mask the real emotions (Wellman et al., 2006). The sixth milestone was hidden emotion long task. This task implied hiding emotions as a strategy to protect yourself in special situations (e.g. when a kind of leader offends you in such a way that is funny for the group) (Wellman and Liu, 2004). Achievement of the short hidden emotion task was a little easier to than the long one. However, location difference was much less than expected a priori. Previous results showed that the hidden emotion long task was the more difficult item in the Rasch analysis of the 5-items ToM-s scale: location at 7.21 on a scale whose mean was 4.46 (SD = 1.71) (Wellman and Liu, 2004). Wellman et al., (2006) changed the long hidden emotion task for the short version of the task. A Rasch analysis also indicated that the short version was the most difficult item in the 5-items scale: location at 6.36 on a scale whose mean was 3.71 (SD = 1.91). Current study was the first time that Rasch analysis was applied to data from both tasks. The location in the hierarchy of the short version as an easier task than the long version might be due to its lower comprehension requirements (Pons et al., 2003).

The whole ToMas-child scale was found to fit the Rasch model even with two tasks of hidden emotions. No statistics indicated that any of the tasks were redundant (fit residuals of both tasks were far from -2.5). Given the results, both tasks contribute to the latent trait of ToM. Specific contribution might be due to the type of emotion of each task (deception and fear). Emotion type in hidden emotion tasks played a role in the understanding of a sample of preschoolers (Banerjee, 1997).

Having two hidden tasks in the ToMas-child scale might also give the chance to capture individual differences in children's understanding of emotions in relation to cultural factors. Molina et al. (2014) found that children between 3 and 5 years from

different cultures (German and Italian) performed similarly in all components of the ToM related to understanding emotions, except for the items of hiding emotions (VII component of the Test of Emotion Comprehension of Pons and Harris, 2000). Cultural differences in development of understanding of hidden emotions were also found in transcultural studies with children from UK (Pons et al., 2004), Japan (Gardner et al., 1988), China (Tang et al., 2017), and India (Joshi & MacLean, 1994).

The Sally-Anne task is the only one that was removed from the scale due to misfit. Results about this items indicated that the Sally-Anne task was redundant. This means the item does not add any information about the construct that is not already added by the rest of items because there already is another false belief task. This is similar to in studies that applied two false belief tasks (Wellman et al., 2006; Wellman & Liu, 2004). This finding implies that if this item were not removed, the overall score would be artificially inflated as a result of a redundant item. This finding supports the assertion that Rasch analysis provides a method to make careful measurement (Grimby et al., 2012).

Some authors claim that research has focused too much into false beliefs neglecting others components (Burack et al., 2001; Miller, 2012). Therefore, we gathered all the items of the ToMas-child that had a unique contribution to the ToM construct in a Core scale and kept the Sally-Anne task as a separate item which score cannot be added to the rest. The Core scale measures mental states such as desires, knowledge, emotions, and emotional regulation strategies, along with false beliefs. Keeping Sally-Anne item into the ToMas-child scale allows comparison with many studies that still use it (Beaudoin et al., 2020).

Regarding the reliability of the scale, the Person Separation Index of 0.7 indicates that the ToMas-child could be applied as a screening test to detect which children have reached an appropriate level of ToM and which have not.

There are several avenues for future investigation following these findings. Some improvements can be made to increase the ability of the scale to measure the ToM more in detail. We found there are some gaps between locations of items in the continuum of the latent construct. New items could be tested to close these gaps and cover the whole spectrum of the ToM. There are gaps between the first and the second item (0.8 logits), the second and the third (1.3 logits), and the fourth and the

fifth (1.15 logits). Furthermore, new items with a high degree of difficulty could be tested to enlarge the end of the continuum.

5.4.1 Limitations

Two main limitations emerged from this study. First, the validation process was focused only on construct validity and other strategies based on concurrent and divergent validity were not taken into account. However, each of the tasks in the ToMas-child scale has been validated in numerous previous research studies. Secondly, a convenience (not a random or cluster) sampling strategy was applied. Children were drawn from rural and urban population, but due to the sampling bias further studies should investigate whether the results can extrapolate to the general Spanish population.

5.4.2 Conclusions

The ToMas-child is a unidimensional scale with adequate construct validity for the assessment of the Theory of Mind in children aged 3-7 years. It contains a Core scale of 6 items -one of them is double, about mental states of own and others? desires, knowledge, emotions, and strategies. Reliability of the ToMas-child guarantees its use as a screening tool. The Sally-Anne false belief task was kept into the scale as an extra item that cannot be added to the overall scale score but could be useful to make comparison between studies. Proposals for future improvements on the scale have been made after Rasch analysis. Spanish version of the validated ToMas-child scale and an English translation are available in the Supplementary files.

5.5 Supplementary files

5.5.1 ToMas-child (English version)

Aim: to assess the development achieved in the Theory of Mind (ToM) in childhood.

Application: individual.

Components: seven items, one of them with 2 parts.

Age: children from 3 to 7 years.

Instructions: At the beginning, explain to the child that you are going to play with some characters. In each item, give the specific instructions that appear in the descriptions below.

Score: 1 point for each correct item, except for item number 2 that is scored with 0.5 to each of the two independent parts.

CORE SCALE

Item 1: Diverse Desires

Aim: to assess whether the child understands that his/her wishes are not common to all and that two people (the child and another person) have different wishes regarding the same object (snack).

Materials: a drawing of fruit, a drawing of cookies and a drawing of an adult person (Alonso).

Method: the child sees the drawing of the adult and then the drawing of the fruit and cookies. We tell him/her:

- "This is Alonso, it's time for a snack and he wants to eat something. We have two things to eat, fruits and cookies, what do you prefer?" (Question about own desire).

  If the child chooses the fruit, we have to tell:

- "Well, it's a good option, but Alonso really likes cookies, he doesn't like fruits" (if he chooses the cookie, we tell him Alonso likes fruit).

  Here we ask to child the target question:

- "It's time to eat something and Alonso can only choose one of the two, what do you think that he will choose? Choose fruit or cookies?"

Scoring. For the answer to be correct, the child must answer the opposite to the question about his own desire.

Item 2
Part-A: Diverse Beliefs

Aim: to assess whether the child understands that two people (the child and another person) have different beliefs about the same object, when the child does NOT know the correct answer.

Materials: a drawing of a girl, a garden and a garage.

Method: the child see the drawing of a girl, a garden and a garage. We tell:

- "This is Barbara. Barbara wants to find her cat. The cat could be hidden in the garden or it could be hidden in the garage."
- "Where do you think Barbara's cat could be? In the garden or in the garage?" (Question about selfconfidence).

  If the child chooses the garden, we have to tell:

- "Good choice, but Barbara thinks it is in the garage" (if the child says that he/she thinks it is in the garage, we tell that Barbara thinks her cat is in the garden).

  Then we ask the target question:

- "So where will Barbara look for her cat? In the garden or in the garage?"

Scoring. For the task to be correct, you must answer the target question instead of the question about your own belief.

Part-B: Knowledge Access

Aim: to assess whether the child understands the lack of knowledge of another person about the contents of a container when the child DOES know what it contains.

Materials: one box, one toy figure (dog / duck / bear) and a drawing of a child.

Method: the child see a box closed, he/she cannot see that the box has inside. We tell:

- "See this box, what do you think that the box has inside?"

  The child will say that it contains anything or does not know what is inside the box.

  After, the child can see the content:

- "Let's see, there is a duck / dog / bear inside!"

  The box is closed and we ask:

- "Ok, what's in the box?"

  Below is the image of a girl:

- "This is Erika. She has never seen what is inside the box. So, does Erika know what is inside the box?"

- "Has Erika seen the inside of the box?"

Scoring. For the answer to the item to be correct, the answers to both the Target question and the memory question must be "no".

Item 3: Belief-Emotion

Aim: to assess whether the child understands the emotions and beliefs derived when the belief is wrong.

Material: a toy representative of a character, a box with a drawing clearly identifiable of its contents and erasers.

Method: we present the character and the box saying:

- "This is a cheese box. It is the favourite food of Minnie. What do you think is inside the box?"

  Minnie tells:

- "Oh, how good! I love cheese, it's my favourite snack"
- "Now I'm going to play for a while." (Minnie disappears from the scene).

  Next, we open the cheese box and we tell to child:

- "Let's look the box ..."
- "It do not have cheeses, it only has erasers!"
- "There are only erasers, no cheeses."

  We close the box and ask:

  "What is Minnie's favourite snack?

  Now, Minnie come back to the scene and we tell:

- "Minnie has never seen what's inside the box."

  "Minnie is coming"

- "Now is the snack time. Let us give him the box."
- "How do you think that Minnie feels before to open the box? Is she happy or sad?" (Target question).

  We open the box and staged as Minnie looked at inside the box:

- "And now, how do you think that Minnie feels after to open the box? Is she happy or sad?" (Question Control emotions).

  Scoring. For the answer to be correct, you must answer "happy" to the target question and "sad" to the question about changing emotions.

Item 4: False Contents Belief

Aim: to assess whether the child understands the error of thinking of another person when another person looks at a box characteristic of something. The child knows what the box really contains.

Materials: a box clearly characteristic of a type of food (Pringles chips), some pencils to put inside the box, a drawing of a child.

Method: the child will see the chip box and we will ask:

- "This is a box of chips, what do you think is inside?"

  Then, we open the box and say:

- "Let's see, really what's inside are pencils!"

  We close the box again and ask:

- "So what's in the box?"

  Then the child see the drawing:

- "This is Iker. He has never seen what is inside the box. So, what do you think that Iker will thing that the box has? Chips or pencils?" (Question of the objective).

- "Has Iker seen what is inside the box of chips?" (Ask a little memory).

  Scoring. For the answer to the item to be correct, the answer to the Objective question must be "pencils" and the answer to the memory question must be "no".

Item 5: Hidden Emotion-short

Aim: to assess whether the child understands that in social contexts a person can experience an emotion but not manifest it and express a different one.

Materials. Two drawings, one of a happy face and another of a sad face.

Method. First, the child see the drawings to verify that the child knows these emotional expressions.

We will ask:

- "Look at these 2 faces, which one of them is happy? In addition, which one is sad?" Then the two drawings are deleted and we tell the next story:
- "Today is Sofia's birthday. She really wants her uncle to give her a bike. When she arrives home after school, Sofia realises her uncle has given her a ball".

  After the brief history, we ask to child:

- "How do you think that Sofia feels when she sees the gift? Is she happy or sad?" (Question Control of emotion felt).

  The child sees two drawing and we ask how does he/she think Sofia feels? Then, we ask:

- "How do you think Sofia will act when she meet her uncle if her uncle bought the ball with very emotion? Happy or sad?" (Target question of expressed emotion).

  Scoring. For the answer to be correct, you must say or indicate that Sofia will feel sad (Target question about the felt emotion) but that she will be happy (Target question of the expressed emotion).

Item 6: Hidden Emotion-short

Aim: to assess whether the child understands that in social contexts a person can experience an emotion and hide it, expressing a different emotion.

Materials: a drawing of a child's back and three drawings of three different facial expressions (happiness, sadness and "neutral").

Method: First, we show the three faces to the child. We ask:

- "Look at these 3 faces, which one is happy?, which one is sad?, which one is neutral?".

  We show the drawing of the three faces and show the drawing where there is a child who does not show his face:

- "This child is Raul. Today, he and his friends have been playing and joking. Rosa, one of the oldest children, told a mean joke about Raul and everyone laughed. Everyone thought it was fun, except Raul, he did not think it was a funny joke. However, Raul did not want the other children to know how he felt about the joke, because then they would tell him that he is a baby. Therefore, Raul tried to hide how he felt".

  After the story, we ask the boy / girl:

- "What did the other children do when Rosa joked Raul?" (Question memory control 1).

- "What would the others say about Raul if they knew how he was feeling?" (Question memory control 2).

  Then show the three faces again:

- "So how did Raul feel when everyone laughed? Did he feel happy, sad or normal?" (Point to the issue of felt emotion).

- "What face did Raul try to have when everyone laughed? Did he make a happy, sad or normal face?" (Objective issue of expressed emotion).

Scoring. For the answer to be correct, the answer to the objective question of the felt emotion must be more negative than the answer to the objective question of the expressed emotion. For example, "sad" to the felt emotion and "happy or normal" to the expressed emotion, or "normal" to the felt emotion and "happy" to the expressed emotion.

FALSE BELIEF TASK

Item 7: Sally and Anne

Aim: to assess whether the child understands that another person's belief about the place where an object must be will be wrong when the object was move when the person was not present.

Materials. Two drawings of two girls, two different boxes and a small ball.

Method: the child sees the two drawings of the two girls, the two boxes and the ball:

- "These are Sally and Anne, who are playing with a ball".
- "And here there are two boxes, one is from Sally and the other from Anne".
- "Now, Sally keeps the ball in her box".
- "...and Sally leaves".

  In this moment, Sally left the scene and we tell the child:

- "Now, Anne picks up the ball and changes it".
- "Now, Sally come back, where do you think that Sally will look for the ball?"

  Scoring. It is correct to respond (or point to) the box of Sally.

ANSWER SHEET

Table 5.3 shows the answer sheet for the English version.

Table 5.3 Answer sheet (English version)

Code (ID): Date:

CORE SCALE							
Item		Requirements	Control/Memory Questions		Target Questions		Score
1	Diverse Desires		Own Desire	Fruit	Alonso´s desire	Fruit	
				Cookies		Cookies	
2 A	Diverse Beliefs		Own Beliefs	Garden	Barbara´s beliefs	Garden	*
				Garage		Garage	
2 B	Knowledge Access	What is inside the box?	Has Erika seen the inside of the box?	Yes	Does Erika know what is inside the box?	Yes	*
				No		No	
3	Belief-Emotion	What do you think is inside the box?	How do yo think that Minnie fells after to open the box?	Happy	How do you think that Minnie fells before to open the box?	Happy	
				Sad		Sad	
4	False Contents Belief	What is inside the box?	Has Iker seen what is inside the box of chips?	Yes	What do you think that Iker will think that the box has?	Chips	
				No		Pencils	
5	Hidden Emotion-short		How do you think that Sofia fells when she see the gift?	Happy	How do you think that Sofia will act when she her uncle?	Happy	
				Sad		Sad	
6	Hidden Emotion-long	What did the other children do when Rosa joke Raul? What would the others say about Raul if they knew how was he feeling?	How did Raul when everyone laughed?	Happy	What face did Raul try to have when everyone laughed?	Happy	
				Neutral		Neutral	
				Sad		Sad	
TOTAL SCORE (Sum of items 1 to 6)							
FALSE BELIEF TASK							
7	Sally-Anne	Where do you think that Sally will look for the ball?				Sally box	
						Anne box	

Notes. 1 point each correct item (item #2: 0.5 point each part *).

5.5.2 ToMas-child (Spanish version)

Objetivo: evaluar el desarrollo logrado en el desarrollo de la Teoría de la Mente (ToM) en la infancia.

Componentes: siete ítems, uno de ellos con 2 partes.

Aplicación: individual.

Edad: de 3 a 7 años.

Instrucciones: al principio, le explicamos al infante que vamos a jugar con algunos personajes. En cada ítem, tendremos que dar las instrucciones específicas que aparecen a continuación.

Puntuación: 1 punto por cada ítem correcto, excepto en el ítem número 2 que se puntúa con 0,5 a cada una de las dos partes de forma independiente.

ESCALA PRINCIPAL (Ítems 1 a 6)

Ítem 1: Deseos diversos

Objetivo: evaluar si el infante comprende que sus deseos no son comunes a los de todo el mundo y que dos personas (el infante y otra persona) pueden tener deseos diferentes con respecto al mismo objeto (merienda).

Materiales: un dibujo de fruta, un dibujo de galletas y un dibujo de una persona adulta (Alonso).

Método: el infante ve el dibujo del adulto y luego, el dibujo de la fruta y las galletas. Nosotros decimos:

- "Este es Alonso, es hora de la merienda y quiere comer algo. Tenemos dos cosas para comer, frutas y galletas, ¿tú qué prefieres merendar?" (Pregunta sobre el deseo propio). Si el infante elige la fruta, tenemos que decirle:

- "Bueno, es una buena opción, pero a Alonso realmente le gustan las galletas, no le gustan las frutas" (si elige la galleta, le decimos que a Alonso le gustan las frutas). Aquí le hacemos al infante la pregunta objetivo:

- "Es hora de comer algo y Alonso sólo puede elegir una de las dos opciones, ¿qué crees que elegirá? ¿Fruta o galletas?"

  Corrección. Para que la respuesta sea correcta el infante debe contestar a la pregunta objetivo lo contrario que respondió a la pregunta sobre su propio deseo.

Ítem 2:

Parte-A: Creencias diversas

Objetivo: evaluar si el infante comprende que dos personas (el infante y otra persona) tienen creencias diferentes sobre el mismo objeto, cuando el infante NO sabe la respuesta correcta.

Materiales: un dibujo de una niña, un jardín y un garaje.

Método: el infante ve el dibujo de una niña, un jardín y un garaje. Nosotros decimos:

- "Esta es Bárbara. Bárbara quiere encontrar a su gato. El gato puede estar escondido en el jardín o en el garaje".

- "¿Dónde crees que puede estar el gato de Bárbara? ¿En el jardín o en el garaje?" (Pregunta sobre la creencia propia).

  Si el infante elige el jardín, tenemos que decirle:

- "Buena elección, pero Bárbara piensa que está en el garaje" (si el infante dice que él / ella piensa que está en el garaje, le decimos que Bárbara piensa que su gato está en el jardín).

  Luego hacemos la pregunta objetivo:

- "Entonces, ¿dónde buscará Bárbara a su gato?, ¿en el jardín o en el garaje?"

  Corrección. Para que la tarea sea correcta debe responder a la pregunta objetivo lo contrario que a la pregunta sobre su propia creencia.

Parte-B: Acceso al conocimiento

Objetivo: evaluar si el infante comprende la falta de conocimiento de otra persona sobre el contenido de un recipiente cuando el infante SÍ sabe lo que contiene.

Materiales: un dibujo de una niña, una caja y un juguete.

Método: el infante ve una caja cerrada, no puede ver lo que la caja tiene adentro. Decimos:

- "Mira esta caja, ¿qué crees que tiene la caja dentro?".

  El infante dirá que contiene algo o que no sabe lo que hay dentro de la caja.

  Después, el infante puede ver el contenido:

- "¡Veamos, hay un pato/perro/oso dentro!"

  Volvemos a cerrar la caja y preguntamos:

- "Ok, ¿qué hay en la caja?".

  A continuación, se muestra la imagen de una niña:

- "Esta es Erika. Ella nunca ha visto lo que hay dentro de la caja. Entonces, ¿Erika sabe lo que hay dentro de la caja?" (Pregunta objetivo).

- "¿Erika ha visto el interior de la caja?" (Pregunta de memoria)

  Corrección. Para que la respuesta al ítem sea correcta, la respuesta tanto a la pregunta objetivo como a la pregunta memoria debe ser "no".

Ítem 3: Creencia-Emoción

Objetivo: evaluar si el infante comprende las emociones derivadas de las creencias y el cambio de emociones que se produce al contrastar con la realidad las creencias erróneas.

Materiales: un juguete representativo de un personaje, una caja con un dibujo claramente identificable de su contenido (por ejemplo, caja redonda de quesitos triangulares) y gomas de borrar.

Método: presentamos el personaje y la caja diciendo:

- “Esta es una caja de queso. Es la comida favorita de Minnie. ¿Qué crees que hay dentro de la caja?"

  Minnie dice:

- "¡Oh, ¡qué bien! Me encanta el queso, es mi merienda favorita. Ahora voy a jugar un rato". (Minnie desaparece de la escena).

  A continuación, abrimos la caja de queso y le decimos al infante:

- "Miremos la caja ... ¡no tiene quesos, sólo tiene gomas de borrar! Sólo hay gomas de borrar, no hay quesos".

  Cerramos la caja y preguntamos:

- "¿Cuál es la merienda favorita de Minnie?"

  Ahora, Minnie vuelve a la escena y le decimos:

- "Minnie nunca ha visto lo que hay dentro de la caja".

- "Es la hora de la merienda. Démosle la caja".

- "¿Cómo crees que se siente Minnie antes de abrir la caja? ¿Está feliz o triste?" (Pregunta objetivo).

  Abrimos la caja y escenificamos como Minnie mira dentro de la caja:

- "Y ahora, ¿cómo crees que se siente Minnie después de abrir la caja? ¿Está feliz o triste?" (Pregunta de control de emociones).

  Corrección. Para que la respuesta sea correcta el infante debe de responder "feliz" a la pregunta objetivo y "triste" a la pregunta sobre el cambio de emociones.

Ítem 4: Falsa Creencia de Contenido

Objetivo: evaluar si el infante comprende el error en la creencia de otra persona sobre el contenido no esperable de un recipiente muy característico cuando el infante SÍ conoce lo que se ha introducido en el recipiente.

Materiales: una caja claramente característica de un tipo de comida (chips Pringles), algunos lápices para poner dentro de la caja, un dibujo de un infante.

Método: el infante verá la caja de patatas fritas y le preguntaremos:

- "Esta es una caja de papas fritas, ¿qué crees que tiene dentro?"

  Luego, abrimos la caja y decimos:

- "¡Veamos, realmente lo que hay dentro son lápices!"

  Cerramos la caja nuevamente y preguntamos:

- "Entonces, ¿qué hay en la caja?"

  Entonces el infante ve el dibujo:

- "Este es Iker. Nunca ha visto lo que hay dentro de la caja. Entonces, ¿qué crees que Iker pensará que tiene la caja? ¿Patatas o lápices?" (Pregunta objetivo).

- "¿Ha visto Iker lo que hay dentro de la caja de chips?" (Pregunta de memoria).

  Corrección. Para que la respuesta sea correcta el infante debe de responder "lápices" a la pregunta objetivo y "no" a la pregunta de memoria.

Ítem 5: Emoción Oculta (corto)

Objetivo: evaluar si el infante comprende que en contextos sociales una persona puede experimentar una emoción, pero no manifestarla y expresar otra diferente (el objetivo es no ofender a otra persona).

Materiales: dos dibujos, uno de cara feliz y otro de cara triste.

Método: primero, el infante ve los dibujos para verificar que conoce estas expresiones emocionales. Preguntaremos:

- “Mira estas 2 caras, ¿cuál de ellas está feliz? Además, ¿cuál está triste?"

  Luego se retiran los dos dibujos y le contamos la siguiente historia:

- "Hoy es el cumpleaños de Sofía. Ella realmente quiere que su tío le regale una bicicleta. Cuando llega a su casa después de la escuela, Sofía ve que su tío le ha regalado una pelota".

  Después de la breve historia, le pedimos al infante:

- "¿Cómo crees que Sofía se siente cuando ve el regalo?, ¿feliz o triste?” (pregunta control de la emoción sentida).

Se les mostrarán las dos láminas, pidiéndole que señale la que indique cómo se sentirá Sofía.

Entonces, preguntamos:

- "¿Cómo crees que actuará Sofía cuando vea a su tío, si su tío compró la pelota con mucha ilusión?, ¿se mostrará feliz o triste?" (pregunta control de la emoción sentida).

  Corrección. Para que la respuesta sea correcta debe decir o indicar que Sofía se sentirá triste (pregunta objetivo sobre la emoción sentida) pero que se mostrará contenta (pregunta objetivo de la emoción expresada).

Ítem 6: Emoción Oculta (largo)

Objetivo: evaluar si el infante comprende que en contextos sociales una persona puede experimentar una emoción y ocultarla, expresando otra diferente (el objetivo es protegerse a sí mismo).

Materiales: un dibujo de un infante de espaldas y tres dibujos de tres expresiones faciales diferentes (felicidad, tristeza y "neutra")

Método: primero, le mostramos las tres caras al infante. Le pedimos:

- “Mira estas 3 caras, ¿cuál está feliz? ¿Cuál está triste? Y, ¿cuál está "normal"?".

  Mostramos el dibujo las tres caras y el dibujo donde hay un infante de espaldas:

- "Este niño es Raúl. Hoy, él y sus amigos han estado jugando y bromeando. Rosa, que era de las mayores, contó un chiste de mal gusto sobre Raúl y todos se rieron. Todos pensaban que era divertido, excepto Raúl, él no creía que fuera una broma graciosa. Sin embargo, Raúl no quería que los otros supieran cómo se sentía con la broma, porque entonces le dirían que es un bebé. Por lo tanto, Raúl trató de ocultar cómo se sentía".

  Después de la breve historia, le preguntamos al infante:

- "¿Qué hicieron los otros niños/as cuando Rosa bromeó con Raúl?" (Pregunta control de memoria 1)

- "¿Qué dirían los demás sobre Raúl si supieran cómo se sentía?" (Pregunta control de memoria 2).

Luego muestra las tres caras nuevamente.

- "Entonces, ¿cómo se sintió Raúl cuando todos se rieron? ¿Se sintió feliz, triste o normal?" (Pregunta emoción sentida).
- "¿Qué rostro intentó tener Raúl cuando todos se rieron? ¿Puso cara feliz, triste o normal?" (Pregunta objetivo de la emoción expresada).

  Corrección. Para que la respuesta sea correcta la respuesta a la pregunta objetivo de emoción sentida debe ser más negativa que la respuesta a la pregunta objetivo de emoción expresada. Por ejemplo: "triste" a la emoción sentida y "feliz o normal" a la emoción expresada, o "normal" a la emoción sentida y "feliz" a la emoción expresada.

Tarea de Falsa Creencia

Item 7: Sally y Ana

Objetivo: evaluar si el infante comprende que la creencia de otra persona sobre el lugar en el que se encuentra un objeto debe ser errónea cuando se ha manipulado su localización mientras no estaba presente esa persona.

Materiales. Dos dibujos de dos chicas, dos cajas diferentes y una pelota pequeña.

Método: el infante ve los dos dibujos de las dos niñas, las dos cajas y la pelota:

- "Estas son Sally y Ana, que están jugando con una pelota".
- "Y aquí hay dos cajas, una de Sally y otra de Ana".
- "Ahora, Sally guarda la pelota en su caja".
- "... y Sally se va".

  En este momento, Sally ha dejado la escena y le contamos al infante y representamos como:

- "Ahora, Ana saca la pelota y la cambia de caja".

- "Ahora, Sally regresa, ¿dónde crees que buscará Sally la pelota?"

  Corrección. Para puntuar la respuesta como correcta debe responder (o señalar) la caja de Sally.

HOJA DE RESPUESTAS

Table 5.4 shows the answer sheet for the Spanish version.

5.5.3 Materials/Materiales ToMas-child

Fig. 5.2 Item 1: Diverse Desires/Deseos Diversos

Fig. 5.3 Item 2A: Diverse Beliefs/Creencias Diversas

Table 5.4 Answer sheet (Spanish version)

Código (ID): Fecha:

ESCALA PRINCIPAL							
Ítem		Preguntas Requisito	Preguntas Control/Memoria		Preguntas Objetivo		Puntuación
1	Deseos Diversos		Deseo Propio	Furta Galletas	Deseo de Alonso	Furta Galletas	
2 A	Creencias Diversas		Creencia Propia	Jardín Cochera	Creencia de Bárbara	Jardín Cochera	*
2 B	Acceso al Conocimiento	¿Qué hay dentro?	¿Erika ha mirado dentro?	Sí No	¿Erika sabe lo que hay dentro?	Sí No	*
3	Creencia-Emoción	¿Que crees que hay dentro?	¿Cómo crees que se siente Minnie después de haber mirado dentro?	Feliz Triste	¿Cómo crees que se siente Minnie antes de mirar dentro?	Feliz Triste	
4	Falsa Creencia de Contenido	¿Qué hay dentro?	¿Iker ha mirado dentro?	Sí No	¿Qué piensa Iker que hay en la caja?	Patatas Lápices	
5	Emoción Oculta (corto)		¿Cómo crees que se siente cunándo ve el regalo?	Feliz Triste	¿Cómo crees que se comportará delante de su tío?	Feliz Triste	
6	Emoción Oculta (largo)	¿Qué hicieron los otros niños cuando Rosa bromeó con Raúl? ¿Qué dirían los demás sobre Raúl si supieran cómo se siente?	¿Cómo se sentía Raúl cuando todos rieron?	Feliz Neutral Triste	¿Qué cara trató Raúl de poner cuando todos rieron?	Feliz Neutral Triste	
PUNTUACIÓN TOTAL (Suma ítems 1 a 6)							
TAREA DE FALSA CREENCIA							
7	Sally y Ana	¿Dónde cree Sally que está la pelota?				Caja Sally Caja Ana	

Notes. 1 point each correct item (item #2: 0.5 point each part *).

Fig. 5.4 Item 2B: Knowledge Access/Acceso al Conocimiento

Fig. 5.5 Item 3: Belief-Emotion/Crencia-Emoción

Fig. 5.6 Item 4: False Contents Belief/Falsa Creencia de Contenido

Fig. 5.7 Item 5: Hidden Emotion-short/Emoción Oculta-breve

Fig. 5.8 Item 6: Hidden Emotion-long/Emoción Oculta-largo

Fig. 5.9 Item 7: Sally and Anne/Sara y Ana

"Desechad tristezas y melancolías.
La vida es amable, tiene pocos días
y tan sólo ahora la hemos de gozar."

Federico García Lorca

6

EMPIRICAL RESEARCH. Training Effectiveness in Positive Emotions, Change Reaction, and Peer Greeting after Childhood TBI: Single-Case Study

Published in: Rivas-García, S., Paúl, N., Catena, A., & Caracuel, A. (2023). Effectiveness of training in expressing positive emotions, reacting to change and greeting peers after childhood traumatic brain injury: A single-case experimental study. *Frontiers in Psychology, 14*, 1195765
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6.1 Introduction

Social cognition (SC) is a complex capacity made up of skills related to emotion processing, social knowledge, theory of mind, and empathy (McDonald & Genova, 2021). All of them play a decisive role in social integration (Frith, 2008). Emotion processing is the capacity to discern and express emotions, while social knowledge is the ability to decode and interpret behavior in specific social situations, such as understanding social norms, roles, and goals and how these can influence the behavior of others. Theory of mind (ToM) is the ability to understand other people's minds, including their interests, beliefs, emotions, and intentions. Finally, empathy allows us to respond to the thoughts and feelings of others with an appropriate emotion (Byom & Mutlu, 2013; Dennis et al., 2012; Neumann et al., 2022). Childhood is a key time in the development of these skills that people need to interact and function successfully in society (Bulgarelli et al., 2022). However, traumatic brain injury (TBI) at childhood is a leading cause of disability (Dewan et al., 2016) that have detrimental effects on cognition, emotion, behavior (Genova et al., 2019) and social functioning (Bedell & Dumas, 2004). After TBI, social impairment is often a consequence of social cognition deficits (Feeney & Achilich, 2014). The review by Ju et al. (2021) provides evidence that disruption in ToM plays a key role in the difficulties in social functioning of children and adolescents with TBI. Deficits in ToM have been found related to others cognitive problems such as dysexecutive behavior, and both are significant predictors of less social participation (Westerhof-Evers et al., 2017).

In addition to deficits in ToM, after TBI the person often shows deficits in the other components of CS (Tousignant et al., 2018). Emotion processing is impaired because the person shows difficulty recognizing emotional expressions from different media, including audio and visual channels, and still versus moving screens (Mcdonald & Saunders, 2005). In relation to social knowledge, Mah et al. (2005) demonstrated that deficits in this component contribute to the aberrant social behavior observed after brain injury. Finally, in relation of the empathy, Hillis' review shows that people with brain injury have impaired this component (Hillis, 2014) and it has widespread and deep implications for social function in children with TBI (Dennis et al., 2013).

SC deficits persist for at least two years after TBI in one in four children (Anderson et al., 2017). Sirois et al. (2019) argue that there are shortcomings in the detection of these deficits, and therefore SC tasks should be included in assessment protocols employed following childhood TBI. In this regard, the instruments available are questionnaires for parents such as the Children's Empathy Quotient (EQ-C) (Auyeung et al., 2009) and performance-based tools, for example, the ToMaschild (Rivas-Garcia et al., 2020) which measures ToM in children aged three to seven years. However, researchers have highlighted the need to develop more instruments to assess social cognition during childhood (On et al., 2022). Concerning SC intervention approaches, most programs have been designed for people with autism or schizophrenia (Cassel et al., 2016; Loubat & Astudillo-Zúñiga, 2019). Three widely used programs focus on emotion recognition (Bornhofen & Mcdonald, 2008a; Murphy et al., 2021), —the Micro-Expression Training Tool (Russell et al., 2006), the Emotion Management Training (Hodel et al., 2004), the Program Emotion Training (Silver et al., 2004) and the Training of Affect Recognition (Wölwer et al., 2005). However, for people with TBI, there are far fewer programmes aimed at improving CS that have been shown to be effective (Rodríguez-Rajo et al., 2022). In addition, most programs only address the processing of emotions (McDonald et al., 2013; Radice-Neumann et al., 2009; Williasom & Isaki, 2015). The Reading a Smile program (Bornhofen & McDonald, 2010) is one of them. It has been shown to improve the ability of adults to judge basic emotional stimuli when presented in video format and to make social inferences based on the speaker's behavior (Bornhofen & Mcdonald, 2008b). However, developing child-specific rehabilitation programs remains a key challenge due to most of them are aimed at adolescents and adults (Cassel et al., 2016). Another challenge, according to the review by Vallat-Azouvi et al. (2019), is the need to design interventions whose effect generalizes and improves social skills in everyday life. For this purpose, the single-case experimental design (SCED) — widely used in research with TBI patients (Nahum et al., 2014; Penn et al., 2005)— is now being extended to address SC deficits shown by such individuals (Rietdijk et al., 2019; Vassallo & Douglas, 2021). In particular, the A-B-A' design has shown validity in intervention studies for improving social cognition (Peyroux & Franck, 2016), increasing social skills and decreasing challenging behaviors (Binder et al., 2019; Jacobson & Truax, 1992).

In summary, there is a need for programs that target SC problems in children with TBI, that take into account the different components of CS that are deficient and with an ecological approach through training in everyday life behaviors. This study aimed to determine the efficacy of three interventions applied to a child with TBI, each targeting a specific behavior altered by social cognition deficits: (1) expression of positive emotions, (2) reacting to changes in plans, and (3) greeting peers.

6.2 Method

Design

The present study was designed following SCED guidelines (Kratochwill et al., 2013; Tate et al., 2013), taking into account the Risk of Bias in Trials Scale N of 1 (RoBiNT) (2015) and the Single-Case Reporting Guidelines for Behavioral Interventions (SCRIBE) (2016). The checklist with each of the items of the RoBiNT scale is specified in Table 6.2 (supplemental material), and those of the SCRIBE scale are shown in Table 6.3 (supplemental material).

The child's parents provided written informed consent. Subsequently, an A-B-A' fall-back/withdrawal design was applied, and the target behaviors were agreed upon following a discussion with the child's family. The participant was blinded to the study design. At the baseline phase, the child was unaware that his behaviors were being recorded, one of which was captured by a video camera. This arrangement was used to avoid any intentional behavior modifications. At the beginning of the intervention phase, the family explained to the child that he would participate in a study aimed at people with TBI. However, neither the characteristics of the study nor the fact that certain behaviors would be assessed outside the session was explained to the child. Finally, the child did not know that his behaviors were being recorded in the withdrawal phase (as with the previous phases).

The participant received three different interventions, one for each target behavior. Each phase included a minimum of nine data points. We randomized the order of the three targeted behaviors and the starting day of the intervention phase for each, taking into account that a minimum of nine measures were required at baseline. The three interventions were developed sequentially. The baseline for the next intervention

was not started until the follow-up phase was completed after the withdrawal of each intervention. In this way, the possible influence of each intervention on the next target behavior was controlled by checking the stability of the baseline for each behavior. The researchers who explained the objectives to the parents also conducted the rehabilitation programs. Another researcher directed data collection and analyses. Neither was blinded to the phase of the study.

Participant

Selection criteria

The researchers of this study provided the inclusion/exclusion criteria to one public pediatric hospital so that the center could use this information to refer potential participants. The inclusion criteria for this study were (1) being a child between the age of 5-15 years, (2) having suffered brain damage, (2) having impaired social cognition, and (3) having previously attended therapy. The exclusion criteria for this study were (1) having language problems and (2) having attention problems.

Participant characteristics

David (pseudonym) is a nine-year-old boy who lives with his parents and siblings. He is the middle child and has close daily contact with other family members, such as his grandparents and uncles. When David was seven years old, he had a domestic accident that resulted in a TBI classified as severe.

MRI performed after the injury showed multiple peripheral microhemorrhagic corticosubcortical foci in the right cerebral hemispheres, predominantly in the deep white matter of the right frontal lobe and bilateral posterior frontobasal regions, compatible with hemosiderin deposits associated with diffuse axonal injury. The last MRI, performed two months before the start of the present study, concluded that the participant´s injuries were stable: multiple foci of multifocal axonal injury of the supratentorial convexity and a small nodular hemorrhagic focus in the right middle cerebellar peduncle.

A neuropsychological assessment was carried out prior to the start of the study. Since the accident and up to that time the child had received 2 years of neuro-

psychological rehabilitation. At no time had there been any intervention aimed at social cognition or any school adaptation. In the Kaufman Brief Intelligence Test (K-BIT) (Kaufman, 1990) he obtained an IQ in the 95th percentile (88th percentile in vocabulary and 98th in matrices). In relation to attention, Trail Making Test-part A (Reitan, 1958; norms of Arango-Lasprilla et al., 2017) score placed the participant in the 15th percentile. In relation to executive functions, Trail Making Test-part B score was in the 14th percentile; the Five Digit Test (Sedó, 2007; norms of Rodríguez et al., 2012) in the 55th percentile; and the Tower of London Drexler (TOLDX) in the 10th percentile (Culbertson & Zillmer, 1998).

As for emotional recognition, the Ekman 60th Faces Test (Ekman & Friesen, 1976; norms of Gómez-Pérez et al., 2016) score was in the 70th percentile (anger 62th, disgust 97th, fear 10th, happiness 32th, sadness 65th and surprise 62th). Social knowledge were assessed with the Faux Pas Test (Baron-Cohen et al., 1999) and the score obtained placed the child in the 5th percentile. Theory of Mind and empathy was assessed by the Stories of Everyday Life test (Kaland et al., 2002; norms of Lera-Miguel et al., 2016) where the physical inference score was at the 29.8th and the mental inference at the 10th, and the Empathy/Systemizing Quotient (EQ-SQ) (Auyeung et al., 2009) where score was at the 12.9th percentile in EQ and 44th percentile in SQ.

During the interview with the parents and the child and the administration of the tests, problems of language comprehension or expression were discarded. His parents reported that, prior to TBI, David had excellent relationships with his siblings and classmates and spent his free time playing sports and socializing with his friends. Now, David's parents reported that he has deficits in most situations that involve (1) expressing positive emotions, (2) adapting to changes in plans and routine, and (3) initiate contact with schoolmates.

Concerning expressing emotions, the family detailed that David is always indifferent to any situation, even on those exceptional occasions when they consider him to be happy. Regarding the reaction to changes in plans, David's parents stated he is too strict with his daily routines. If an activity is changed or a plan is not carried out, even if the family explains why, David does not understand and refuses to accept the situation. Finally, the family is concerned that David has no relationships with his classmates, he does not even greet them when he arrives at school. He attends

school daily and participates in extracurricular activities but limits himself to doing what the teacher or the coach says without interacting with others. At recess, David prefers to be alone rather than with his classmates.

Context and Approvals

The study was conducted face-to-face at the Mind, Brain, and Behaviour research center of the University of Granada. First, the principal researchers of the study met with the parents to explain the single-case study methodology and to specify the behaviors to be studied. Then, after determining the design and developing the specific intervention, a second meeting was held to explain all the details. Then, once the parents signed the "informed consent" document, the study began. During the first two weeks, a pilot study was conducted to familiarize the parents with the data collection process, after which the baseline data collection began. Finally, the interventions, which were conducted by the principal researchers, were carried out at the research center. The study was conducted following the Declaration of Helsinki and approved by the Human Research Ethics Committee of the University of Granada (Nº certificate 706/CEIH/2018).

Interventions

The researchers designed and implemented three different interventions, one directed at each target behavior. Some activities were adapted from the "Reading a smile" program (Bornhofen & McDonald, 2010), while others were created to respond to the study objectives. The three interventions work on four types of content across ten sessions, each lasting 40 minutes. Further details of some of these activities can be found in the supplementary material. For further information, please contact the corresponding author.

Target Behavior 1: Expression of positive emotions

The aim was for David to express more positive emotions. To achieve this objective, the CS component that was worked on was the processing of emotions. The elements of the intervention were (a) differentiating between positive and negative emotions (Session 1), (b) identifying the emotions felt in hypothetical situations

(Sessions 2-3), (c) learning how to express each emotion (Sessions 4-8), and (d) analyzing the expressions and behaviors shown from personal experiences with each of the emotions worked on and offering proposals for behavioral change (Sessions 9-10). Further details of these activities can be found in the supplementary material. However, as an example we summarize here the essence of one of the activities carried out as part of this intervention:

- Activity title: Emotionary (initial level).
- Objective: learn to differentiate the different emotions and classify them as positive and negative.
- Resources: the digital platform mobbyt.
- Method: show each emotion, explain what it means and given an example. Afterwards, the participant is asked to match emotion with its definition.
- Emotions worked on: surprise, anger, sadness, fear, happiness, disgust, nervousness.

Target Behavior 2: Reacting to change in plans

The goal was for David to decrease his negative reactions and increase his positive reactions to changes that occur. To achieve this goal, two components of CS were trained: ToM and social knowledge. The intervention was mainly aimed at improving ToM so that David could understand others when they needed to make changes in plans or routines. In addition, training to improve social knowledge was also included at the end of the intervention. For this, he analyzed different reactions of himself and others to changes in plans and, when they were considered inappropriate, he had to propose alternatives. For the alternatives to be correct, the child had to take into account what others were thinking and feeling and that the response was appropriate for the particular social context. The contents of the program were (a) learning that other people may have different tastes or preferences from him (Sessions 1-3), (b) understanding that sometimes the plan must be altered for an unexpected reason (Sessions 4-5), (c) understanding that the plan can be altered because at that moment

the others do not feel like it (Sessions 6-7), and (d) analyzing the behaviors shown in response to a change of plans and propose alternatives when such behaviors were considered inappropriate (Sessions 8-10). An example of the activities carried out in this intervention was:

- Activity title: Diverse tastes
- Objective: Learning that other people may have different tastes or preferences than he does
- Resources: stories, paper and pen.
- Method: a story is read where the characters have different tastes. Answer several questions about what each character would feel. Then, he has to give an example of a situation in which he did not have the same taste as someone else.
- Example of story: Sofia loves basketball, but hates water sports. However, Claudia wants to be a professional swimmer. When they get to gym class, the teacher explains that they are playing swimming today.
- Questions: How did Sofia feel? / How did Claudia feel?
- Last step: Think of a situation in which you did not like an activity but someone else did.

Target behavior 3: Greeting peers

In this case, the objective was for David to greet his classmates when they arrived at school. To achieve this goal, three components of CS were worked on: social knowledge, theory of mind and empathy. The contents were (a) learning the basic social rules of relating to others (greetings, farewells, asking how they are (Sessions 1-3), (b) analyzing the behavior of different characters through videos and texts, and deciding what could be done and what had to be changed (Sessions 4-7), (c) analyzing specific situations where he had not complied with the social rules and what he should have done (Sessions 8-9), and (d) analyzing how his behavior has

changed since he started therapy and how he feels now (Session 10). An example of the activities carried out in this intervention was:

- Activity title: Is everything correct?
- Objective: Analyzing behavior of different characters, through videos and texts, and deciding what could be done and what had to be changed
- Resources: video, paper and pen.
- Method: Watch a video or read a story in which a person engages in inappropriate behavior. Answer several questions about how the characters behaved. He then has to give an example of a situation in which he did not act as he should.
- If the video is very long, it is divided into 15-minute periods and a section is worked on.
- Example of video: A Christmas Carol-Disney.

Measures

Measurements of the first and second behaviors were taken every day. Those of the third behavior were taken from Monday to Friday, because there is no school on weekends. In total, the study lasted 151 days and, if the weekends of the third behavior are not counted, the data were collected in 140 days.

Target behavior 1: the researchers gave the family a list of the positive emotions that David worked on in the intervention. The parents organized a daily meeting or assembly of the five family members to discuss the day's best moment. Parents often discuss this topic with their children, so this meeting was common for the family. The parents asked their children what their best moment of the day was and to describe their emotion(s). To avoid the influence of siblings, David was always encouraged to be the first to answer. Both parents wrote down their children's answers. Later, they reviewed and verified their notes to ensure they were identical. The dependent variable was the number of positive emotions expressed by David during each daily family meeting.

Target behavior 2: the parents wrote down David's reactions and responses to altering a pre-established action plan or routine. To comply with the study design, the family drew up a weekly schedule specifying their activities. A few hours before the planned activity was due, the parents told David it would not take place, explaining the reason for the change. The dependent variables were (a) acceptance or rejection of the change and (b) the intensity of the negative reaction in the case of rejection. For measuring the first variable, David's mother described his reaction as acceptance or rejection. For the second variable, the family was given a scale (0-10) to rate the intensity of the reaction. Specific examples of each level were detailed on the scale to facilitate a consistent rating. In addition, the researchers also reviewed the recordings to verify the score given to the behavior.

Target behavior 3: David's mother recorded his behavior while waiting to enter the school with a pair of camera glasses (Banglin© 1080P HD micro SD 32GB). Dependent variables were (a) the number of initiatives David took to greet his classmates and (b) how many of them he greeted before entering the classroom in the morning. For measuring both variables, the parents reviewed the recordings at home to record in a log: (a) whether David had the initiative to approach any classmate, and (b) how many children David greeted/interacted with. In addition, the researchers also reviewed the recordings to verify the score given to the behavior.

Data analysis

The Non-overlap of all pairs (NAP) statistic and split-half trend estimation method (S-HTEM) were applied to analyze quantitative variables. In addition, chi-square test (χ^2) results and a graphical representation of percentages in each phase were presented for categorical variables.

The NAP is a non-parametric technique to measure the non-overlap or 'dominance' of a quantitative variable between two phases. This analysis considers all possible overlaps between phases (baseline-intervention, intervention-withdrawal, baseline-withdrawal) as it provides a pairwise comparison between all first and second-phase data. Therefore, it could be interpreted as the percentage of non-overlapping data between the two phases (Manolov & Moeyaert, 2017). The NAP effect can be rated as weak (0-.31), medium (.32-.84), or large (.85-1) (Parker et al., 2011; Parker &

Table 6.1 Results of the non-overlap of all pairs (NAP) statistics for each quantitative dependent variable.

Target behaviour order (cuantitative variable)	Baseline-Intervention (A vs B)			Intervention-Withdrawal (B vs A´)			Baseline-Withdrawal (A vs A´)		
	NAP	CI90%	*p*	NAP	CI90%	*p*	NAP	CI90%	*p*
1st (Number of positive emotions expressed)	0.067	-0.063<>0.744	0.165	0.712	0.117<>0.733	***0.023***	0.864	0.354<>1	**0.001**
2sd (Intensity of negative reactions)	0.540	-0.251<>0.412	0.691	0.815	0.314<>0.947	***0.001***	0.836	0.306<>1	***0.003***
3rd (Number of classmates greeted)	0.883	0.351<>1	***0.002***	0.346	-0.676<>0.062	0.171	0.844	0.297<>1	***0.004***

Notes. NAP, non-overlap of all pairs; CI, Confidence interval.

Vannest, 2009). NAP was calculated using the online program[1] (Vannest et al., 2016). Graphical representation of the S-HTEM shows the baseline trend. A significant change is considered to have occurred when three or more consecutive measurement points deviate from the trend in the intervention or withdrawal phases (Lane & Gast, 2014; Manolov et al., 2016).

6.3 Results

Target Behavior 1: Expression of positive emotions

The NAP revealed a significant change in the number of positive emotions between phases B and A' (medium effect) and A vs. A' (large effect) (see Table 6.1). Inspection of the S-HTEM graph indicates that three consecutive assessment points were above the trendline in the intervention phase and 13 in the withdrawal phase (see Fig.6.1). Both analyses revealed a significant increase in the expression of positive emotions throughout the intervention, which maintained and strengthened the effect size in the withdrawal phase.

Target Behavior 2: Reacting to change in plans

[1] http://singlecaseresearch.org/calculators/nap

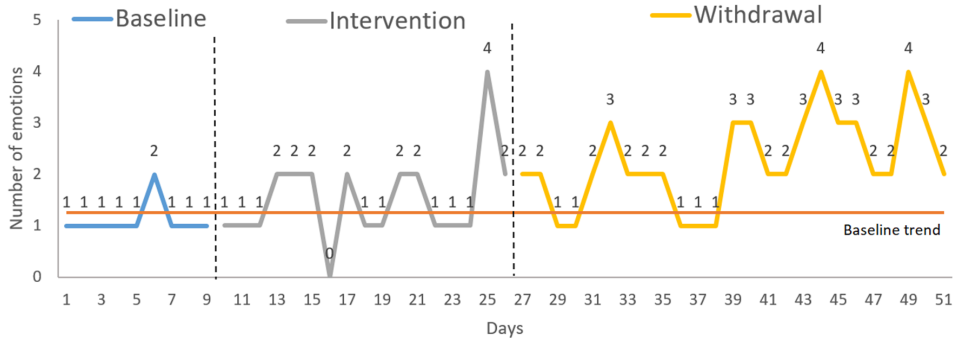


Fig. 6.1 Target behavior 1: expression of positive emotions. Analysis: S-HTEM (split-half trend estimation method).

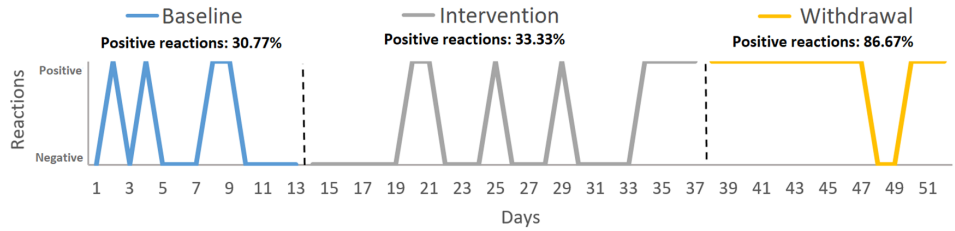


Fig. 6.2 Target behavior 2: reacting to change in plans. Variable: acceptance or rejection of the change. Analysis: percentage of positive reactions with respect to the total number of reactions in each phase.

For the categorical variable acceptance or rejection of changes, the chi-squared test (χ^2) showed a significant change between phase B and A' (χ^2=10.565, p=0.001) and A vs. A' (χ^2=9.123, p=0.003). In addition, the graph showed that acceptance increased significantly in the withdrawal phase (86.67 %) (see Fig. 6.2).

Regarding the intensity of negative reactions when the change was rejected, the NAP showed a significant change between phase B and A' and between A and A' (see Table 6.1) with a medium effect size. The S-HTEM graph shows an increase in negative reactions in the intervention phase that declined at the end of this phase (the last four points indicated no negative reaction), a trend that continued throughout all but one of the days of the withdrawal phase (see Fig. 6.3).

Target Behavior 3: Greeting peers

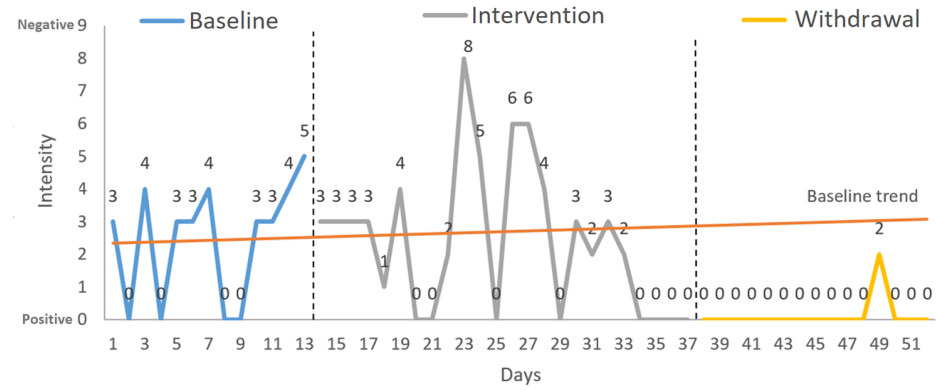


Fig. 6.3 Target behavior 2: reacting to change in plans. Variable: intensity of the negative reaction. Analysis: S-HTEM (split-half trend estimation method).

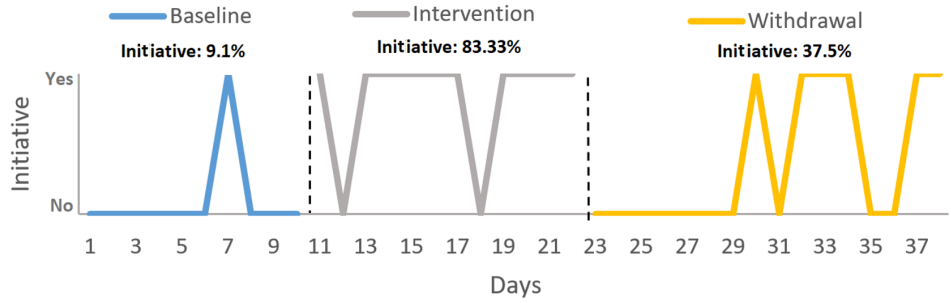


Fig. 6.4 Target behavior 3: greeting peers. Variable: initiative to greet. Analysis: percentage of initiative with respect to the total number of initiative in each phase.

For the categorical variable initiative to greet, χ^2 revealed significant changes between phases A and B (χ^2=11.733, p=0.001) and between phases B and A' (χ^2=5.882, p=0.015). Figure 6.4 shows that the participant's initiative to greet his classmates increased in the intervention phase, reaching 83.33 %, but this decreased in the withdrawal phase (37.5 %).

Regarding the number of classmates that David greeted, the NAP showed a significant (large effect size) increase between baseline and the other phases (A vs. B and A vs. A') and no change between B and A' (see Table 6.1). The S-HTEM graph shows more than three consecutive assessment points above the trendline in the intervention phase. Concerning the withdrawal phase, although many assessment

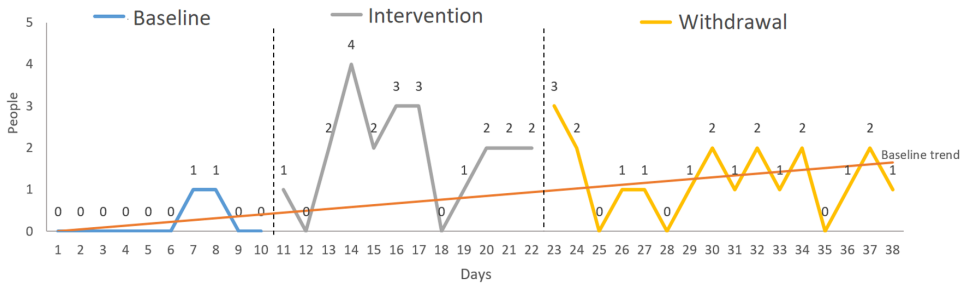


Fig. 6.5 Target behavior 3: greeting peers. Variable: number of classmates greeted by David. Analysis: S-HTEM (split-half trend estimation method).

points are above the line, these are not consecutive. This means that, although the treatment effect continued, it was not stable (see Fig. 6.5).

6.4 Discussion

We aimed to determine the efficacy of three interventions to improve three behaviors categorized as social cognition deficits in a nine-year-old boy with TBI.

The first intervention was directed toward improving the expression of positive emotions. To achieve this objective, the CS component that was worked on was the processing of emotions. When assessed at baseline, David would only express one positive emotion. However, during and after the intervention, he managed to express three or four. This finding indicates that the treatment was impactful, producing a large effect (Parker & Vannest, 2009) that persisted after withdrawal. Many people, like David, find it difficult to recognize and express their and others' emotions after TBI (Nahi et al., 2022), which can limit their social and personal development (Binder et al., 2019). For instance, Lancelot and Gilles (2019) showed that deficits in emotion recognition hinder the development of social knowledge, which is key for integration into everyday social life (Lancelot & Gilles, 2019). Moreover, such impairments can also impede the correct development of the other components of social cognition, such as theory of mind or emotional empathy (Allain et al., 2019). For this reason, the social participation of people with TBI is very limited or non-existent (Westerhof-Evers et al., 2019). Therefore, the scientific literature suggests

that any social cognition rehabilitation program designed for people with TBI should be directed at treating problems with emotion recognition (Vallat-Azouvi et al., 2019). Furthermore, the literature points out that the person must recognize and express positive emotions before working with negative emotions, so initial rehabilitation should focus on these positive emotions (Mieles Toloza et al., 2020). However, most rehabilitation programs simultaneously work on positive and negative emotions (Rodríguez-Rajo et al., 2018). This study has shown the effectiveness of training designed to improve the recognition and expression of positive emotions, which alone was sufficient since the participant could already express negative emotions.

The second target was behavior was reacting to change in plans. The findings showed an increase in acceptance behaviors during the intervention and withdrawal phases. Furthermore, the intensity of the negative reaction shown when David did not accept change decreased in the intervention and withdrawal phases compared to baseline. This pattern of results reflects a clear improvement in his flexibility toward accepting change. On the few occasions when David expressed rejection toward changes, he did so more adaptively, with a less intense negative emotional response. In the intervention for this behavior, two components of SC were worked on: theory of mind and social knowledge. To our knowledge, no comparable published programs exist for people with TBI. However, compared with other interventions that have addressed various components of SC in other populations (e.g., people with schizophrenia), this program is considerably shorter. The intervention time is usually between 16-24 sessions of one hour each (Nahum et al., 2014; Penn et al., 2005). Aside from the difference in specific characteristics of the population, the tailored and personalized activities could be key to its effectiveness. Considering that SC is not a unidimensional construct (Cassel et al., 2016), the training content and the participants' deficits must be accurately defined (Domínguez Morales et al., 2002). Subsequently, rehabilitation should then be tailored according to the participants and their family's characteristics and lifestyles (Oberholzer & Müri, 2019; Turner-Stokes et al., 2005).

Finally, the third intervention was aimed at the target behavior of greeting classmates. In the intervention for this behavior, three components of SC were worked on: social knowledge, theory of mind and empathy. The results showed that the intervention increased David's tendency to greet and initiate interactions with his

peers. However, this initiative decreased during the withdrawal phase. In terms of the number of people greeted by David, this increased rapidly from almost none at baseline to three or four during the intervention and then stabilized at just one or two on most days of the withdrawal phase. According to the NAP, this change means that the intervention had a medium effect by the end of the study. However, when considering the split-half trend estimation method, the graph indicates that the initial change was not sufficiently strong to be maintained during the withdrawal phase. Our findings show that David experienced two positive changes in his interactions with peers during the active training phase, taking more initiative to greet and to greet a greater number of his peers. Although the NAP found no significant difference between the intervention and withdrawal phases in terms of the number of greetings, visually, it can be seen that the effects did not show the desired level of stability. Once the intervention had finished, the exchange of greetings remained higher than in pre-treatment because a couple of peers continued to greet him even though David no longer showed the same initiative as in the previous phase. The trend described above may be due to the complexity of the targeted behavior. In particular, Cassel et al. (2016) review shows that the average duration of training programs that include several SC components is between 16 and 25 hours. Moreover, social interaction is one of the biggest challenges faced by people with TBI (Snapp & Martin, 2020). Therefore, longer time frames are recommended for future interventions aimed at improving interactions with others due to the persistent nature of these debilitating social impairments resulting from pediatric TBI (Anderson et al., 2017; Lancaster et al., 2019).

6.4.1 Conclusions

Our results show the effectiveness of two interventions targeting the expression of positive emotions and reacting positively to change of plans in a nine-year-old boy with TBI. However, the intervention aimed at greeting peers was only effective during the training phase, so a longer protocol is recommended to achieve desired outcomes that are more persistent over time.

6.4.2 Limitations and Strengths

This study has several limitations. First, we employed the A-B-A' design, which, although effective in this population (Cassel et al., 2020; Peyroux & Franck, 2019), could be extended in future studies to include more phases (e.g., A-B-A-B). A more extensive study design will allow for obtaining a larger data set and increase internal validity. Second, while only the participant was blinded to the aims of the intervention, the parents and the researcher was aware of the phases of the study and inter-rater reliability was not conducted. In addition, the real-life observational measures that have been used are ecologically valid but have a high degree of subjectivity. Achieving potential improvements in this regard would be challenging but desirable for future studies. Third, concerning assessment and intervention, the use of machines is recommended. However, the feasibility of their use depends on the behaviors to be worked on and the participant's characteristics. For this particular study, assessment and intervention using machines would be highly complex, considering the behaviors that have been targeted. Specifically, concerning the third behavior — improving interaction with others — any intervention must involve contact with others and not only work with a machine. Finally, it is recommended that future studies include replications (one original and three replications), specifying generalization measures for each phase.

A notable strength of this study is that it was conducted according to the standards of the SCED guidelines (Kratochwill et al., 2013; Tate et al., 2013), taking into account the Risk of Bias in Trials Scale N of 1 (RoBiNT) (2015) and the Single-Case Reporting Guidelines for Behavioural Interventions (SCRIBE) (2016). The RoBINT (2015) scale is composed of 15 items divided into two subscales: (1) Internal validity subscale (Items 1-7) and (2) External validity and interpretation subscale (Items 8-15). Concerning the assessment, each item is assigned a score between 0-2. The total scale score is 30 points, with 14 points allocated to the internal validity subscale and 16 points to the external validity and interpretation subscale. While most published single-case studies assessed with the RoBINT scale score less than 15 points (Beckers et al., 2020), this study scored 19 points and thus has a higher score than most published articles (see Table 6.2 supplemental material).

Finally, the SCRIBE guide consists of 26 items covering all the factors to be considered when conducting a single case study. However, as with the RoBINT scale, studies that use the guide do not fully comply with all the items (MacIntosh et al., 2020), and even when it is stated that this guide has been taken into account in the study design, the considered items are not specified (Sauer-Zavala et al., 2019; Sniewski et al., 2022). In contrast, the present study complied with 24 of the items set out in the SCRIBE guidelines (see Table 6.3 supplemental material).

6.5 Supplementary files

6.5.1 Supplementary Figures and Tables

See Tables 6.2 and 6.3.

6.5.2 Supplementary Data

In this study, the researchers created three interventions, each targeting one target behaviour: (1) Expression of positive emotions (Table 6.4), (2) Behavioural flexibility (Table 6.5), and (3) Interaction with classmates (Table 6.6). The three interventions consist of four blocks of content and have a duration of 10 sessions of 40 minutes each. The applications used for the development of the activities were Mobbyt, Kahoot, Quizizz and Youtube.

Examples of some activities

Activity 1. Emotionary (Fig. 6.6).

Method: show each emotion, explain what it means and given an example. Afterwards, the participant is asked to match emotion with its definition.

Activity 2. What emotion did we feel?

Method: the participant is asked to given an example of each of the emotions worked on.

Materials: Emotions worked out (Fig. 6.7).

Activity 3. Sorting emotions. (Fig. 6.8).

Method: This activity is divided into two parts. In the first part, the participant has to classify the emotions worked on in three categories: (1) Positive, (2) Negative and (3) Both, in this category we include emotions that can be confusing. In addition, several examples are specified in order to classify them. In the second part, the participant adds emotions.

Activity 4. What emotion is felt in each situation? (Fig. 6.9).

Method: a situation with four emotions is shown. The participant has to choose the emotion that can be felt in each situation.

Activity 5. Can we say everything we think? (Fig. 6.10).

Method: various situations are shown where the participant has to identify the emotion that the person will feel and determine whether that comment is appropriate or not.

Activity 6. Facial recognition. (Fig. 6.11).

Method: the three areas of the face they should look at to recognize the emotion expressed by the person (forehead, eyes and mouth) are explained. Then, they are shown how these areas should look like for each of the emotions and they are asked to recognize the emotion that appears in the images. Finally, the child must express with his/her face the emotions that have been worked on.

Activity 7. What emotion does each character feel?

Method: several videos are shown in which they have to recognize the emotion expressed by each character.

Materials: the stories used were: (1) Mickey's Christmas Carol, (2) Rock, Paper, Scissors, (3) Empathy, Hedgehog Story and (4) For Sale Mouse.

Table 6.2 Risk of Bias in N-of-1 Trials (RoBiNT) Scale Record Form (Tate et al. 2015).

INTERNAL VALIDITY (IV) SUBSCALE					
1	Design with control	2 Points: At minimum: ABAB with 4 phases; concurrent multiple-baseline design (MBD) with 6 phases, 3 tiers; alternating-treatments design (ATD) with 4 sets of alternating sequences; changing-criterion design (CCD) with 4 steps; for medical N-of-1: 3 x AB pairs.	2	***1***	0
		1 Point: ABA or 3 phase variant; concurrent MBD with 4-5 phases, 2 tiers; ATD with 3 sets of alternating sequences; CCD with 3 steps; for medical N-of-1: 2 x AB pairs.			
		0 Points: AB; AB+follow-up; non-concurrent MBD; ATD with <3 sets of alternating sequences; CCD with <3 steps; nonwithdrawable treatment in ABA.			
WHERE: Line 215 “An A-B-A’ fall-back/withdrawal design was applied”. See under the heading “Design”.					
2	Randomisation	2 Points: Randomise: sequence (order) and/or onset (start point) for all phases (see manual for exceptions).	***2***	1	0
		1 Point: Restricted randomisation (e.g., participants to blocks of sequences); counterbalancing.			
		0 Points: No information; randomisation of other aspects of the study (e.g., stimulus materials).			
WHERE: Line 229-230 “We randomized the order of the three targeted behaviors and the starting day of the intervention phase for each”.					
3	Sampling of behaviour	2 Points: 5 or more data points in every phase with data presented.	***2***	1	0
		1 Point: at least 3 data points in every phase with data presented.			
		0 Points: <3 data points in any phase.			
WHERE: Line 231 “a minimum of nine measures were required at baseline”. See under the heading “Design”.					

Table 6.2 Risk of Bias in N-of-1 Trials (RoBiNT) Scale Record Form (continued).

4	Blinding of people involved in the intervention	2 Points: Both participant and practitioner blind to phase of study. If technological intervention used, consult manual.	2	***1***	0
		1 Point: Participant or practitioner blind to phase. If technological intervention used, consult manual.			
		0 Points: Neither participant nor practitioner are blind to phase.			
WHERE: Line 217-226 “The participant was blinded to the study design. At the baseline phase, the child was unaware that this behaviors were being recorded, one of which was captured by a video camera. This arrangement was used to avoid any intentional behavior modifications. At the beginning of the intervention phase, the family explained to the child that he would participate in a study aimed at people with TBI. However, neither the characteristics of the study nor the fact that certain behaviors would be assessed outside the session was explained to the child. Finally, the child did not know that his behaviors were being recorded in the withdrawal phase (as with the previous phases)”. See under the heading “Design”.					
5	Blinding of assessor(s)	2 Points: Assessors blind to all phases; use of computer/machine free from human involvement; outcomes self-report and participant is blind.	2	1	***0***
		1 Point: Independent assessor(s), but not blind to phase.			
		0 Points: Practitioner collects/extracts/scores/processes the data; no mention of blinding or independence of assessor(s).			
WHERE: Recording was carried out through (1) parental reports and (2) behavioural recordings. The researchers then analysed the records and recordings. Both the family and the researchers were aware of the study and the phases. The procedure is detailed in the Measures section of the article.					
6	Interrater agreement	2 Points: Machine-generated data or data sampled from ≥20% per condition, analysed and reported per condition, with ≥80% agreement (k≥0.6, etc).	***2***	1	0
		1 Point: A reasonably objective measure (as defined in the manual) used or agreement is ≥70% (k≥0.4) even if (a) data are not calculated and reported per condition and/or (b) <20% of data is sampled per condition.			
		0 Points: Agreement <70% (k<0.4, etc); subjective measure used; consensus ratings alone; inter-rater agreement only reported for a previous study.			

Table 6.2 Risk of Bias in N-of-1 Trials (RoBiNT) Scale Record Form (continued).

WHERE: Line 494-498 “The Non-overlap of all pairs (NAP) statistic and split-half trend estimation method (S-HTEM) were applied to analyze quantitative variables.In addition, chi-square test (X2) results and a graphical representation of percentages in each phase were presented for categorical variables”. See under the heading “Data analysis”.					
7	Treatment adherence	2 Points: Machine-delivered intervention free from human implementation or adherence assessed (i) against a clear rating system, (ii) assessor is independent of practitioner/participant, (iii) ≥20% of is data sampled, (iv) resulting in ≥80% adherence. 1 Point: Adherence meets 2/4 criteria above, and includes (a) assessor independent of practitioner and (b) adherence ≥70%. 0 Points: Adherence <70%; assessor not independent of practitioner; components only loosely related to adherence.	2	1	***0***
WHERE: This study had three different interventions, one for each behaviour. Some activities have been adapted from the "Read a smile" program (Bornhofen and McDonald 2010) and others were created to respond to the objectives set. The three interventions work on four types of content in ten sessions. Each session lasts 40 minutes. The activities can be found in the supplementary material. For more information please contact the corresponding author.					
EXTERNAL VALIDITY AND INTERPRETATION (EVI) SUBCALE					
8	Baseline characteristics	2 Points: Analysis of baseline characteristics and age, sex, aetiology, severity of condition. 1 Point: Analysis of baseline characteristics or age, sex, aetiology, severity of condition. 0 Points: No analysis of baseline conditions or incomplete listing of the four participant characteristics.	2	***1***	0
WHERE: Line 515-555. See under the heading "Results".					
9	Setting	2 Points: Description of general location and detailed description of the specific environment. 1 Point: Description of either general location or specific environment but details are sparse. 0 Points: Neither general location nor specific environment are described.	***2***	1	0
WHERE: Line 108-133. See under the heading "Participant".					

Table 6.2 Risk of Bias in N-of-1 Trials (RoBiNT) Scale Record Form (continued).

10	Dependent variable (target behaviour)	2 Points: Detailed description of content of the intervention including any equipment/manuals (for medical N-of-1: content of the agents, both active and placebo) and 3 procedural details: number, duration (dosage for medical N-of-1) and frequency of sessions.	***2***	1	0
		1 Point: General description of content of intervention (and equipment/manuals) and 2/3 procedural details (number, duration/dosage, frequency).			
		0 Points: Intervention described in general terms; only identified as a treatment approach (e.g., “cognitive-behaviour therapy”); <2/3 procedural details.			
WHERE: Line 447-489. See under the heading "Measures".					
11	Independent variable (therapy/ intervention)	2 Points: Detailed description of content of the intervention including any equipment/manuals (for medical N-of-1: content of the agents, both active and placebo) and 3 procedural details: number, duration (dosage for medical N-of-1) and frequency of sessions.	***2***	1	0
		1 Point: General description of content of intervention (and equipment/manuals) and 2/3 procedural details (number, duration/dosage, frequency).			
		0 Points: Intervention described in general terms; only identified as a treatment approach (e.g., “cognitive-behaviour therapy”); <2/3 procedural details.			
WHERE: Line 336-443. See under the heading "Interventions".					
12	Raw data record	2 Points: Raw data record with a data point for every session/observation period. If ≥10 individual trials, complete raw data record for ≥3 cases.	***2***	1	0
		1 Point: xIf ≥10 or more individual trials, complete raw data record for 2 cases, or provision of a data record but data aggregated/averaged across sessions/periods, or provision of data record but a priori decision not to record data for every session (e.g., multiple probe studies).			
		0 Points: No raw data reported; data only reported for selected phases, omitted data.			

Table 6.2 Risk of Bias in N-of-1 Trials (RoBiNT) Scale Record Form (continued).

WHERE: Line 515-555. In this research, data collection for each of the interventions carried out has been daily. The data are reflected in the visual analysis. See under the heading "Results".					
13	Data analysis	2 Points: Systematic visual analysis with specified protocol, or visual analysis aided by quasi-statistical techniques, or statistical analysis with rationale. 1 Point: Systematic/aided visual analysis with selection of analytic techniques, or statistical analysis but no rationale, or a priori decision re the level of the target behaviour constituting an empirically derived clinically meaningful change. 0 Points: Visual inspection without data analysis; analysis not conducted on target behaviour; arbitrary selection of level of target behaviour.	***2***	1	0
WHERE: Line 492-514. Data analysis was based on several statistical techniques applicable to each of the target behaviours. Analyses were (1) non-overlap of all pairs (NAP), (2) split-half trend estimation method (S-HTEM), (3) Chi-square test (X2) and (4) percentage of behaviours in each phase in relation to the total number of recorded behaviours. See under the heading "Data analysis".					
14	Replication	2 Points: 1 original + 3 replications (direct inter-subject or systematic including settings, behaviours, practitioners, intervention). 1 Point: 1 original + 1 or 2 replications (inter-subject or systematic). 0 Points: No replication.	2	1	***0***
WHERE: This study is not replicated.					
15	Generalisation	2 Points: Specified generalisation measure is probed in every phase 1 Point: Specified generalisation measure is probed only in pre- and post-treatment phases 0 Points: No generalisation measures	2	1	***0***
WHERE: The measure of generalisability is not specified in this study.					
Internal Validity Subcale: 8/14		***External Validity and Interpretation subcale: 11 /16***	***TOTAL SCORE 19/30***		

Table 6.3 The Single-Case Reporting Guideline In BEhavioural Interventions (SCRIBE).

TOPIC		ITEM DESCRIPTION	WHERE
TITLE and ABSTRACT			
1	Title	Identify the research as a single-case experimental design in the title	Line 1. “Effectiveness of training in expressing positive emotions, reacting to change and greeting peers after childhood traumatic brain injury: a single-case experimental study”.
2	Abstract	Summarize the research question, population, design, methods including intervention/s (independent variable/s) and target behavior/s and any other outcome/s (dependent variable/s), results, and conclusions	Line 77-102. See under the heading “Abstract”
INTRODUCTION			
3	Scientific background	Describe the scientific background to identify issue/s under analysis, current scientific knowledge, and gaps in that knowledge base	Line 109-200. See under the heading “Introducction”
4	Aims	State the purpose/aims of the study, research question/s, and, if applicable, hypotheses	Line 193-200. See the last paragraph under the heading "Introduction".

Table 6.3 The Single-Case Reporting Guideline In BEhavioural Interventions (continued).

METHOD			
DESIGN			
5	Design	Identify the design (e.g., withdrawal/reversal, multiple-baseline, alternating-treatments, changing-criterion, some combination thereof, or adaptive design) and describe the phases and phase sequence (whether determined a priori or data-driven) and, if applicable, criteria for phase change	Line 205-240. See under the heading “Design”
6	Procedural changes	Describe any procedural changes that occurred during the course of the investigation after the start of the study	The procedure has not been modified in this study.
7	Replication	Describe any planned replication	This study has not been replicated
8	Randomization	State whether randomization was used, and if so, describe the randomization method and the elements of the study that were randomized	Line 104-106. See the last paragraph under the heading "Design".
9	Blinding	State whether blinding/masking was used, and if so, describe who was blinded/masked	Line 227-240. See under the heading “Design”
PARTICIPANT/S or UNIT/S			
10	Selection criteria	State the inclusion and exclusion criteria, if applicable, and the method of recruitment	Line 246-253. See under the heading “Selection criteria”
11	Participant characteristics	For each participant, describe the demographic characteristics and clinical (or other) features relevant to the research question, such that anonymity is ensured	Line 255-314. See under the heading “Participant characteristics”

Table 6.3 The Single-Case Reporting Guideline In BEhavioural Interventions (continued).

CONTEXT			
12	Setting	Describe characteristics of the setting and location where the study was conducted	Line 317-333. See under the heading "Context and Approvals"
APPROVALS			
13	Ethics	State whether ethics approval was obtained and indicate if and how informed consent and/or assent were obtained	Line 318-333. See under the heading "Context and Approvals"
MEASURES and MATERIALS			
14	Measures	Operationally define all target behaviors and outcome measures, describe reliability and validity, state how they were selected, and how and when they were measured	Line 447-489. See under the heading "Measures"
15	Equipment	Clearly describe any equipment and/or materials (e.g., technological aids, biofeedback, computer programs, intervention manuals or other material resources) used to measure target behavior/s and other outcome/s or deliver the interventions	Line 447-489. See under the heading "Measures"
INTERVENTIONS			
16	Intervention	Describe the intervention and control condition in each phase, including how and when they were actually administered, with as much detail as possible to facilitate attempts at replication	Line 336-443. See under the heading "Intervention"
17	Procedural fidelity	Describe how procedural fidelity was evaluated in each phase	Fidelity was not calculated
ANALYSIS			
18	Analyses	Describe and justify all methods used to analyze data	Line 492-514. See

Table 6.3 The Single-Case Reporting Guideline In BEhavioural Interventions (continued).

			under the heading
			“Data analysis”
RESULTS			
19	Sequence completed	For each participant, report the sequence actually completed, including the number of trials for each session for each case. For participant/s who did not complete, state when they stopped and the reasons	Line 515-556. See under the heading “Results”
20	Outcomes and estimation	For each participant, report results, including raw data, for each target behavior and other outcome/s	Line 515-556. See under the heading “Results”
21	Adverse events	State whether or not any adverse events occurred for any participant and the phase in which they occurred	Line 515-556. See under the heading “Results”
DISCUSSION			
22	Interpretation	Summarize findings and interpret the results in the context of current evidence	Line 558-779. See under the heading “Discussion”
23	Limitations	Discuss limitations, addressing sources of potential bias and imprecision	Line 793-862.
24	Applicability	Discuss applicability and implications of the study findings	Line 793-901. See under heading “Limitations and Strengths”
DOCUMENTATION			
25	Protocol	If available, state where a study protocol can be accessed	See under the heading “Supplementary material”
26	Funding	Identify source/s of funding and other support; describe the role of funders	See under the heading “Funding”

Table 6.4 Target Behavior 1: Expression of positive emotions.

The aim was for David to express more positive emotions	
Contents	***Activity***
Differentiating between positive and negative emotions	1. Emotionary
	2. What emtion have we felt?
	3. Sorting emtions
Identifying the emtion felt in hypothetical situations	4. What emotion do we feel in each situation?
	5. Can we say everything we think?
Learning how to express each emotion	6. Facial recognition
	7. What emotion does each character feel?
Analysing the expresion and behaviour in personal experience with each of the emotions worked on and proposing proposals for behavioural change	8. Analysing personal experiences

Table 6.5 Target Behavior 2: Reacting to changes in plans.

The aim was for David to decrease his negative reactions and increase his positive reactions to the changes that had occurred (behavioural flexibility).	
Contents	***Activity***
Learning that other people, may have different or preferences than he does	1. Diverse ot tastes
	2. List of tastes
	3. Different tastes
Understanding that somestimes the plan must be altered for an unexpected reason	4. What has happened?
	5. When did something similar happen?
Understanding that the plan can be altered because at that moment the others do not feel like it	6. What does the character feel?
	7. Changing the plan
Analysing the behaviour that has taken place in situations where the behaviour has been modified and proposing how it should be	8. Analysing personal experiences

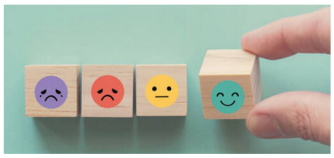
Table 6.6 Target Behavior 3: Greeting peers.

The aim was for David to improve personal interaction with classmates	
Contents	***Activity***
Learning the basic social rules of relating to others (greetings, farewells, asking how they are)	1. Rules social
	2. Steps to take before saying or doing something
Analysing the behaviour of different characters, through videos and texts, and deciding what could be done and what had to be changed	3. Is everything correct?
	4. What to do when I feel negative emotions?
Analysing specific situations where he had not complied with the social rules and what he should have done	5. Analysing personal experiences.
Analysing how his behaviour has changed since he started therapy and how he feels now	6. How have we moved forward?

Emotionary

Initial Level	**Advanced Level**
Link: https://mobbyt.com/videojuego/educativo/?Id=231857	Link: https://mobbyt.com/videojuego/educativo/?Id=177427

Fig. 6.6 Activity 1. Emotionary.



Emotions

SURPRISE	SADNESS	HAPPINESS	ANNOYANCE
ANGER	FEAR	DISGUST	DISCOMFORT
NERVOUSNESS	HOPE	CONTENTMENT	DESPONDENCY
PRIDE	SHAME	LOVE	WORRY
LOVESTRUCK	HEARTACHE	HATRED	PHOBIC
EUPHORIA	JEALOUSY	BOREDOM	FRIENDLINESS
DESPAIR	ENVY	REJECTION	NOSTALGIA
DISAPPOINTMENT	RAGE	ENTHUSIASM	ANGUISH

Fig. 6.7 Activity 2. What emotion did we feel?

POSITIVE	NEGATIVES	BOTH

Fig. 6.8 Activity 3. Sorting emotions.

What emotion is felt in each situation?

Initial Level	Advanced Level
Link: https://create.kahoot.it/share/que-emocion-se-siente-en-cada-situacion/3c734e1a-ee78-4aa6-93b8-316b3dfe74f3	Link: https://create.kahoot.it/share/emocionario-que-emocion-se-siente-en-cada-situacion/d9f656eb-7a44-4275-ae11-2ee147e4b1ba

Fig. 6.9 Activity 4. What emotion is felt in each situation?

Can we say everything we think?

Link: https://quizizz.com/join/quiz/62ebed1c65f056001ef341cc/start?studentShare=true	

Fig. 6.10 Activity 5. Can we say everything we think?

Facial Recognition

Link: https://mobbyt.com/videojuego/educativo/?Id=177437	

Fig. 6.11 Activity 6. Facial recognition.

"No deseo que las Mujeres tengan poder sobre los Hombres, sino sobre ellas mismas."

Mary Wollstonecraft

7

EMPIRICAL RESEARCH. SocialMind Program's Efficacy in Acquired Brain Injury Social Cognition Rehab

Rivas-García, S., Catena, A., & Caracuel, A. (2023). Effectiveness of the SocialMind program for the rehabilitation of the social cognition after acquired brain injury. [Manuscript submitted for publication in Frontiers in Psychology]

7.1 Introduction

People are social beings, which implies that in order to have an integral development we need to relate effectively with others and the environment (Atenas et al., 2019;

Fiske & Taylor, 2008). Social cognition (SC) is the set of skills that allows such social development. SC enables perceiving, understanding, and interpreting one's own and others' intentions, feelings, and thoughts; and also generating adaptive social behaviors to flexibly guide social behavior (Adolphs, 2010; McDonald & Genova, 2021).

SC is a complex skill made up of, at least, four components: emotional processing, social knowledge, theory of mind and empathy (Cassel et al., 2016). Emotional processing is the capacity that enables perception and use of emotions (Hall et al., 2018). Social knowledge is the ability to decode and interpret behavior in specific social situations, including understanding of social rules, roles, goals and how they influence other' behavior (Lima et al., 2020). Theory of mind (ToM) is the ability to understand others' mental states (interests, beliefs, emotions, and intentions), predict their behavior, and understand that these mental states may differ from one's own and also from reality (Byom & Mutlu, 2013). Empathy is the ability to understand, share, and respond to others' emotional experiences by adapting own's behavior to show a flexible response (Laghi et al., 2019). To address the connection and development of these elements, we can identify two approaches. Ochsner (2008) proposes that the assimilation of the components of SC occurs hierarchically. These levels range from the acquisition of values and social-affective responses to context-sensitive regulation. At the first level, emotions and social norms are learned. At the second, responses are generated based on this information. Levels three and four involve processing information taking into account the perspective of others, from simple to complex situations. On the other hand, McDonald (2013) divides into "cold" SC, which encompasses ToM, and "hot" SC with all other components. The differentiation between cold and hot SC is based on the fact that the development of ToM is shaped by rational processes, while in emotional processing, social knowledge and empathy, the emotional processes play a significant role (Wilson et al., 2017).

An adequate development of SC is key to a person's social inclusion (Frith, 2008), and deficits usually provoke low social participation and difficulties integrating into society (Binder et al., 2019). SC deficits may even cause the person to suffer social isolation (Spikman et al., 2012).

Acquired brain injury (ABI), including traumatic brain injury (TBI) is a common source of SC deficits (Maggio et al., 2022). Therefore, in addition to traditional areas

of rehabilitation, such as physical or cognitive recovery, clinicians and researchers alike emphasize the need to intervene in social and interpersonal deficits (Turner-Stokes & Wade, 2004). However, when clinicians evaluate a person with ABI, SC is often not included in their evaluation protocol and, therefore, is not explicitly included in the rehabilitation goals (Togher et al., 2023). Kelly et al. (2017) conducted research involving 443 clinicians from around the world to determine whether people with TBI had impaired SC. The results showed that 84 % of clinicians stated that more than half of their patients had impaired SC. However, 78 % of them reported that they infrequently or never assessed these domains using a formal assessment tool. Sirois et al. (2019) also highlighted the need to include SC assessment in the psychological assessment protocol for individuals with ABI. In addition, they noted that tailored interventions specifically addressing SC should be implemented (Sirois et al., 2019). Due to the low use of standardized assessments, the prevalence of SC impairments following ABI is not fully established. Wallis et al. (2022) demonstrated that 83.11 % of investigations that have assessed SC in individuals with ABI have reported deficits in at least one component of this ability. Regarding to the type of ABI, these authors indicate that 73.7 % of the published studies have focused on the assessment of individuals who have experienced TBI, 15.1 % on stroke, and 20.3 % omitted explicit details about the specific characteristics of the ABI in the samples (Wallis et al., 2022). In relation to people with TBI, Babbage et al. (2011) showed that between 13 % and 39 % of people with moderate to severe TBI may have significant difficulties with facial affect recognition. Furthermore, deficits in SC after TBI have been shown to persist for at least four years in adults (Theadom et al., 2019) and for two years in children (Anderson et al., 2017). In relation to the people with stroke, Adams et al. (2019) conducted a meta-analysis of 58 datasets with 937 people with stroke compared to 1.630 non-clinical controls and concluded that three of the four core domains of social cognitive function were significantly impaired in people with stroke, specifically ToM, social knowledge and emotional processing.

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SC is often not included in their evaluation protocol and, therefore, is not explicitly included in the rehabilitation goals (Togher et al., 2023). Kelly et al. (2017) conducted research involving 443 clinicians from around the world to determine whether people with TBI had impaired SC. The results showed that 84 % of clinicians stated that more than half of their patients had impaired SC. However, 78% of them reported that they infrequently or never assessed these domains using a formal assessment tool. Sirois et al. (2019) also highlighted the need to include SC assessment in the psychological assessment protocol for individuals with ABI. In addition, they noted that tailored interventions specifically addressing SC should be implemented (Sirois et al., 2019). Due to the low use of standardized assessments, the prevalence of SC impairments following ABI is not fully established. Wallis et al. (2022) demonstrated that 83.11 % of investigations that have assessed SC in individuals with ABI have reported deficits in at least one component of this ability. Regarding to the type of ABI, these authors indicate that 73.7 % of the published studies have focused on the assessment of individuals who have experienced TBI, 15.1 % on stroke, and 20.3 % omitted explicit details about the specific characteristics of the ABI in the samples (Wallis et al., 2022). In relation to people with TBI, Babbage et al. (2011) showed that between 13 % and 39 % of people with moderate to severe TBI may have significant difficulties with facial affect recognition. Furthermore, deficits in SC after TBI have been shown to persist for at least four years in adults (Theadom et al., 2019) and for two years in children (Anderson et al., 2017). In relation to the people with stroke, Adams et al. (2019) conducted a meta-analysis of 58 datasets with 937 people with stroke compared to 1.630 non-clinical controls and concluded that three of the four core domains of social cognitive function were significantly impaired in people with stroke, specifically ToM, social knowledge and emotional processing.

Regarding intervention, the rehabilitation of SC for people with ABI is underdeveloped (Kelly et al., 2017) in comparison to other populations such as people with schizophrenia or autism (Cassel et al., 2016; Loubat et al., 2019). After reviewing training programs applied in studies — see supplementary file to compare components, population and duration of the main SC rehabilitation programs —, one characteristic to highlight is that most of them focus only on one or two components of SC (Cassel et al., 2016; Darling et al., 2021; Loubat et al., 2019).

In summary, given its high prevalence and relevance to adequate social functioning, it is essential that SC be assessed in order to intervene for deficits following ABI. There is a lack of comprehensive programs to intervene over all SC components that are usually deteriorated after ABI. Therefore, this study aims to determine the effectiveness of the new "SocialMind" program in improving all components of SC in people with ABI.

7.2 Methods

7.2.1 Participants

A total of 38 participants were recruited, 68.4 % of whom were male. Nineteen participants were randomly included in each of the two study groups (SocialMind group; control group). There were seven dropouts (one from the SocialMind group and six from the control group) attributable to worsening cognitive impairment in two cases, technological difficulties that made it impossible to attend the online sessions in two cases, and cessation of attendance at their rehabilitation center in three cases. Consequently, the study ended with 31 participants, with a male predominance of 67.7 %. The mean age was 37.44 (22.07). Regarding the type of ABI: 48.4 % of them had TBI, 41.9 % stroke and the rest brain tumor.

7.2.2 Procedures

A pre/post intervention pilot study was conducted. Participants were recruited from rehabilitation units in hospitals, brain injury associations and private facilities through direct contact or through the project social media:

- Web: https://www.intervencioncognicionsocial.com/
- Facebook: Social Cognicion
- Instagram: socialcognicion
- Twitter: @SocialCognicion

Inclusion criteria for this study were being between 5 and 70 years old, having suffered an ABI, having impaired SC determined by less than 24 correct items on the MASC (Lahera et al., 2014) for adults and adolescents or less than 13 points on the mental inference subscale of the Everyday Life Stories (Lera-Miguel et al., 2016) for children. The exclusion criteria were having severe language or attention problems that limited the patient's ability to follow the intervention.

The study lasted 44 weeks for each participant, divided into (1) initial meeting, (2) initial evaluation, (3) training and (4) final evaluation. All activities were applied individually. First, an individual information meeting was held with the potential participants or legal guardians in which all the characteristics of the study were explained. Written informed consent was obtained from all participants or their legal guardians to participate in the study. Secondly, the initial SC evaluation was carried out and repeated at the end of the training. The average time dedicated to the evaluation was 2-3 sessions of 1 hour, based on ability and speed of each participant. Thirtly, the SocialMind group followed a training characterized by having a duration of 30 hours distributed in 36 one-hour sessions, one per week, with a 10-minute break. The control group followed the treatment as usual at their respective center. The study was conducted following the Declaration of Helsinki and approved by the Human Research Ethics Committee of the University of Granada (N°certificate 706/CEIH/2018).

7.2.3 Assessment of emotion processing

Baron Cohen's face test (Baron-Cohen et al., 1997) —Spanish version of Huerta-Ramos et al. (2021)—. It measures the recognition of facial emotional expression through twenty images of an actress showing both basic emotions—happy, sad, afraid, surprise, disgust and distress, and complex mental states—scheming, guilt, thoughtful, admiring, quizzical, flirting, bored, interested and arrogant. This test is applicable to children, adolescents and adults (Dziobek et al., 2005; Huerta-Ramos et al., 2021). The overall score is a sum of hits and range between 0 and 20.

7.2.4 Assessment of social knowledge

Faux pas —The children's version of Baron-Cohen et al. (1999) was applied to participants until the age of 15 years and the adult version of Stone et. al. (1998); Spanish version for adult by Fernández-Modamio et al. (2018). Both versions consist of ten stories of faux pas and ten control. In each story of the adult version, participants have to answer eight questions on faux pas detection, understanding of inappropriateness, speaker intention, associated false beliefs, related emotions/empathy, and control questions to ensure that they have understood the story. In each story of the children's version, participants have to answer four questions on faux pas detection, identification, comprehension, and false beliefs. The participant is awarded with one point for each story if he/she answers all the questions correctly. The score is 0 if any of the answers to the item is incorrect. The overall score is a sum of hits and range between 0 and 20.

7.2.5 Assessment of ToM

Movie for the Assessment of Social Cognition (MASC) (Dziobek et al., 2006) —Spanish version of Lahera et al. (2014)—. It was applied to measure ToM in participants from the age of 16. MASC is a film showing four characters spending a Saturday night together. Participants are asked to make inferences about the mental states of the characters in the video. The test takes into account different modalities of mental states —thought, emotions, intentions— with neutral, positive and negative valence. Participants must answer 45 questions, each with four answer options where only one is correct. The questions appear right after each scene of the movie, which is programmed to pause until the person has marked his or her answer. The participant must mark one response that represent one of the following four options: correct attribution of ToM to the characters, overmentalizing error —a mental state that is attributed when there is no reason for it—, undermentalizing error —a present mental state that is not attributed—, or total absence of mentalizing error—an attribution of physical causality rather than a mental state—. The sum of the responses marked for each type of response gives four partial complementary scores: number of hits, number of errors due to overmentalizations, number of errors due to undermentalizations, and number of errors due to absences of mentalization.

The overall number of hits was used in the study. The range of score is between 0 and 45.

Stories of Everyday Life (Kaland et al., 2002). —Spanish version of Lera et al. (2016)—. It was applied to measure ToM in children between 7-15 years. It includes 13 types of stories: lies, white lies, figure of speech, misunderstanding, double entendre, irony, persuasion, contrary emotions, forgetting, jealousy, intentions, empathy and social blunders. Each story has between 10 and 15 control questions to ensure that participants have understood the story. In addition, each story has three essential questions to assess the participant's ability to infer mental and physical state of the characters from the context of the story. Responses are scored as correct —2 points—, partially correct —1 point—, or incorrect —0 points—. The overall score in the mental inference subscale was used in the study, ranging between 0 and 26.

7.2.6 Assessment of Empathy

Each participant was given an age-appropriate version of the Empathy Quotient (EQ) test: Adult version of Baron-Cohen et al. (2004); Adolescent version of Auyenung et al. (2012); Child version of Auyeung et al. (2009). The adult version consists of 60 self-reported items, 40 about empathy (e.g., I can easily tell if someone else wants to enter a conversation) and 20 controls. The versions for children and adolescents are answered by their parents and have 55 and 40 items respectively. Parents are asked to indicate the extent to which they agree with each statement about their child (e.g., *My child often doesn't understand why some things upset other people so much*).

In both versions, there are four answer options (strongly-slightly agree, slightly-strongly disagree). To prevent response bias, half of the items are phrased in a way that the correct answer is to agree, while the other half have the correct answer as disagree. A response indicating a lack of empathy receives a score of zero, a slight empathy response scores one point, and a strong empathy response scores two points. For each empathy item, an individual can obtain a score of 2, 1, or 0. The overall score is calculated by summing up the scores for each item.

7.2.7 Intervention

The rehabilitation program SocialMind was specifically designed for this study and based on activities aimed at improving four SC components: emotion processing, social knowledge, ToM and empathy. The program was conducted online, but is equally applicable both in person and remotely. Its duration is 30 hours in total, in sessions of 1-hour per week, each with a 10-minute break interval.

The program consists of four modules, one for each SC component. The first is emotion processing and the participant will learn to (1) know the different emotions, (2) differentiate between positive and negative emotions, (3) relate each emotion to its facial expression and (4) analyze real life situations to determine if the facial expression they had corresponded to the emotion they were feeling. The second focuses on social awareness and the participant must learn (1) the social norms of different situations, (2) to identify the appropriate behaviors of various characters, and (3) to analyze real-life situations in where they (the participants) did not comply with social norms. The third module is devoted to ToM and the participant must learn (1) that various people can have different perspectives, (2) what indirect language does, and (3) to understand what irony is and how to identify it. Finally, the fourth module deals with empathy and the participant will understand that the other person's feelings must be taken into account before saying or doing something. To do this, the participant is asked to (1) analyze the behavior of various characters and determine whether the action is empathetic, (2) analyze his or her own situations in which he or she has not acted empathetically, and (3) propose alternatives to the non-empathetic actions he or she has taken.

The resources used to carry out the training program have been original stories, images obtained from free banks such as pixabay or pexels, videos/movies and free apps for the creation of online games such as mobbyt (https://mobbyt.com). All tasks have versions adapted to children, adolescents and adults. Figure 1 shows an example of an exercise corresponding to the block dedicated to ToM training for children. The complete program is in the process of being published as a handbook. For more information on the exercises, please contact the authors. Example of a ToM exercise created with the Mobbyt application Fig. 7.1.

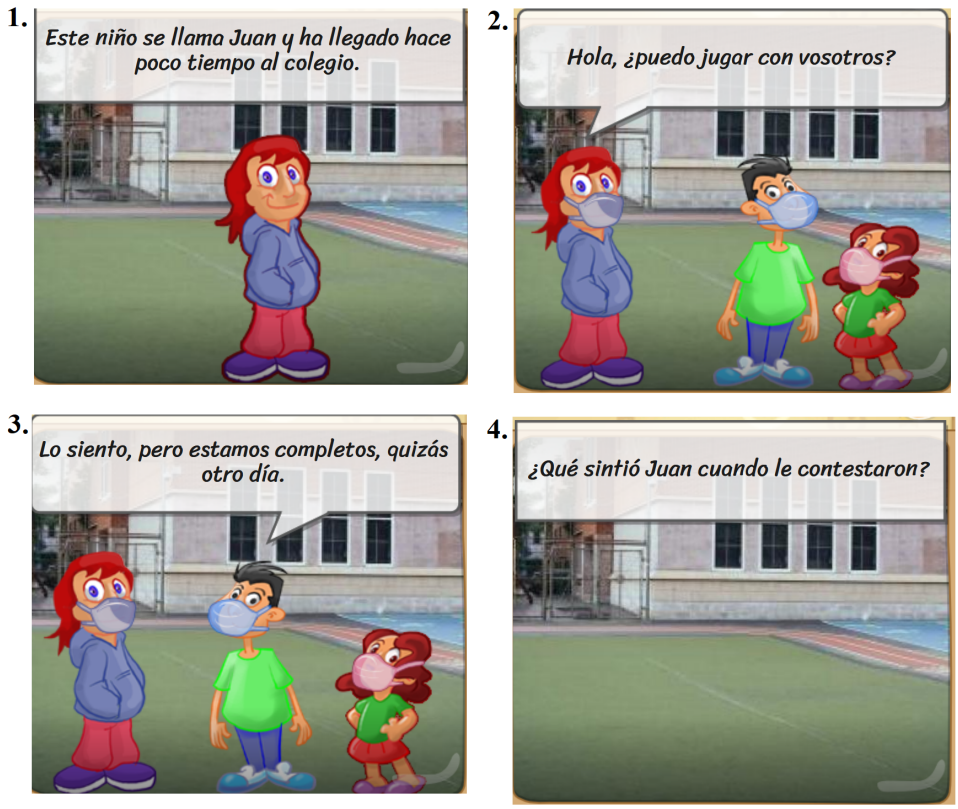

Fig. 7.1 Example of a ToM exercise created with the Mobbyt application.

7.2.8 Statistical analysis

The raw scores for each instrument were transformed into typical scores (Z). Typical scores for the different forms of each test (child, adolescent, and adult versions) were pooled to form a single variable per SC component. Therefore, the ToM variable was formed for the z scores of the MASC hit score (Dziobek et al., 2006) for adolescent and adult participants, and for the Everyday Life Stories (Kaland et al., 2002) score for children.

Non-parametric tests were applied due to the reduced sample size. The Mann-Whitney U-test was applied for the two groups comparison using the individual change for each participant, calculated with the following formula: score at post-

Table 7.1 Scores pre and post intervention.

	SocialMind Group		Control Group	
	Pre Mean (SD)	Post Mean (SD)	Pre Mean (SD)	Post Mean (SD)
Emotion recognition	14.06 (2.16)	15.44 (1.98)	16.00 (3.48)	15.15 (3.21)
Social knowledge	10.89 (5.53)	16.28 (2.82)	14.23 (3.35)	14.31 (3.45)
ToM	9.50 (6.45)	14.72 (7.60)	16.62 (5.59)	18.23 (8.34)
Empathy	27.22 (10.95)	34.00 (16.83)	40.54 (10.17)	36.46 (7.76)

Notes. Emotion recognition: Baron Cohen's face test; Social knowledge: Faux pas; ToM: Movie for the Assessment of Social Cognition (MASC) and Stories of Everyday Life; Empathy: Empathy Quotient.

intervention moment minus score at the pre-intervention. The effect size for the Mann-Whitney U-test was calculated as the Partial Eta Squared according with Lenhard and Lenhard (2016). The data analyzed with the SPSS Statistics version 28 (IBM Corp, 2021).

7.3 Results

Table 7.1 shows the means and standard deviations of each group at the two evaluation moments. Between-group analyses (Table 7.2) revealed a statistically significant improvement in the experimental group compared to the control group in emotional processing, social knowledge and empathy.

7.4 Discussion

This study aimed to determine the effectiveness of the SocialMind program in improving all the components of SC in people with ABI. The results showed that the SocialMind group significantly improved emotion recognition, social knowledge and empathy with respect to the control group. ToM also improved close to significance. The effect size was large for all SC components according to the rule of thumb of Cohen et al., (2003).

Table 7.2 Results from individual change between groups.

	SocialMind Group	Control Group	Mann-Whitney test			Effect size
	Mean Range	Mean Range	U	Z	p	η^2
Emotion recognition	19.28	11.46	58.00	-2.38	.017	.315
Social knowledge	20.81	9.35	30.50	-3.48	<.001	.673
ToM	18.64	12.35	69.50	-1.91	.057	.203
Empathy	20.58	9.65	34.50	-3.30	.001	.605

Notes. Note: Emotion recognition: Baron Cohen's face test; Social knowledge: Faux pas; ToM: Movie for the Assessment of Social Cognition (MASC) and Stories of Everyday Life; Empathy: Empathy Quotient; η^2: Partial Eta squared.

Some training programs designed to address multiple components of SC in other populations have demonstrated effectiveness only in specific domains. The Social Cognition and Interaction Training, a 24 one-hour sessions program for individuals with schizophrenia, includes exercises focused on emotion recognition and Theory of Mind (ToM). However, the results reveal that the program was solely effective in enhancing ToM, but not emotional recognition (Penn et al., 2005). Similarly, among the two six one-hour sessions modules of the Social Cognitive Skills Training, only the emotional processing module displayed significant improvements, while the ToM module did not exhibit notable enhancements in people with schizophrenia (Horan et al., 2009). Lastly, the Virtual Reality Social Cognition Training, designed for individuals with autism to target various SC components demonstrated efficacy in enhancing emotional processing while leaving ToM improvements unrealized (Kandalaft et al., 2013).

If we focus on the few rehabilitation programs aimed at working on SC for people with ABI, Radice-Neumann (2009) conducted a study aimed at improving emotional recognition and ToM, participants improved in emotion recognition, but did not experience significant improvement in the ability to infer the mental states of others. The Treatment for Impairments in Social Cognition and Emotion

Regulation (T-ScEmo) improved both emotion recognition and ToM but not the social knowledge (Westerhof-Evers et al., 2017). Finally, the Computerized Social Cognitive Training program showed a significant improvement in ToM, although no in emotion recognition (Rodríguez-Rajo et al., 2022).

Our findings show that SocialMind is an innovative training program, not only because it is aimed at people with ABI whose SC rehabilitation programs are very scarce (Vallat-Azouvi et al., 2019), but also because it is the only program that has demonstrated effectiveness in more than two components of SC. Regarding the ToM, it is important to highlight that, although the effect size was large, the changes only showed a close proximity to significance. This finding might suggest that the methodology used to work on ToM compared to the one used to work on the rest of the components of SC should be different. Considering the model that divides SC components into two levels, must be different because "cold" cognition involves more cognitive and detached processes, while "hot" cognition encompasses more emotionally charged and context-dependent processes (McDonald, 2013). For this reason, the SocialMind program included, at the end of each module dedicated to working on each of the components of the level referred to as "hot" SC, exercises to work on the emotional process where participants were asked to provide real-life examples of situations they experienced.

On the other hand, regarding the training duration, it is worth noting that the T-ScEmo program of Westerhof-Evers et al. (2017) is divided into three blocks but half of the total intervention time is allocated to the ToM block. That suggest that the rehabilitation of the ToM component requires more time than the rest because this capacity is formed by unique processes that are not trained in the rehabilitation of other skills. Therefore, for future research, it is recommended to increase the time dedicated to training this component.

7.4.1 Conclusions

The SocialMind program introduces a valuable and innovative approach to enhance SC in individuals with ABI. The results of this study demonstrate the program's effectiveness in improving three out of the four key components of this ability.

7.4.2 Limitations and Strengths

Two main limitations emerged from this study. First, the small sample size. Although this is a pilot study, future research should expand the number of participants. Second, the control group did not receive a placebo treatment to match the time and attention with the therapists. In future research, the time participants in both groups spent with the therapist should be monitored and matched.

The strengths and advantages of this study are that a long-term rehabilitation program is presented that includes all components of SC. In addition, the program is designed to be delivered both face-to-face and online, which facilitates the work of the therapist.

7.5 Supplementary files

See Table 7.3.

Table 7.3 Social cognition intervention programs (in chronological order).

Training	SC Components	Population	Duration of training
Theory of Mind Treatment (Steerneman et al., 1996)	Emotional Processing	Autism Spectrum Disorder	21 session/1 hour
Training of Affect Recognition (TAR) (Frommann et al., 2003)	Emotional Processing	Schizophrenia Spectrum Disorder	12 session/45 min
Emotion Management Training (EMT) (Hodel et al., 2004)	Emotional Processing	Schizophrenia Spectrum Disorder	24 session/45 min.
Metacognitive and social cognition training (MSCT) (Hogarty et al., 2004)	Emotional Processing Theory of Mind	Schizophrenia Spectrum Disorder	18 session/1 hour
Social cognition and Interaction Training (SCIT) (Penn et al., 2005)	Emotional Processing Theory of Mind	Schizophrenia Spectrum Disorder	24 session/1 hour
Mind-Reading: Interactive Guide to Emotions (Golan & Baron-Cohen, 2006)	Emotional Processing	Autism Spectrum Disorder	20 session/1 hour
Metacognitive Training (MCT) (Moritz & Woodward, 2007)	Theory of Mind	Schizophrenia Spectrum Disorder	8 session/ 1 hour
Micro Expression Training Tool (METT) (Russell et al., 2008)	Emotional Processing	Schizophrenia Spectrum Disorder	12 session/ 1 hour
Social Cognitive Training (SCST) (Horan et al., 2009)	Emotional Processing Social Knowledge Theory of Mind	Schizophrenia Spectrum Disorder	12 session/ 45 min.
Training Emotional Processing (Radice-Neumann et al., 2009)	Emotional Processing Theory of Mind	Traumatic Brain Injury	9 session/ 1 hour
Emotion and Theory of Mind Imitation Training (Mazza et al., 2010)	Emotional Processing Theory of Mind	Schizophrenia Spectrum Disorder	8 session / 50 min.
Reading a Smile (and other great expressions) (Bornhofen & McDonald, 2010)	Emotional Processing	Traumatic Brain Injury	16 session / 90 min.
Mind Reading: An Interactive Guide to Emtions (MRIGE) (Lindenmayer et al., 2013)	Emotional Processing	Schizophrenia Spectrum Disorder	12 session / 1 hour
Virtual Reality Social Cognition Training (VR-SCT) (Kandalaft et al., 2013)	Emotional Processing Social Knowledge Theory of Mind	Autism Spectrum Disorder	10 session/ 1 hour

Table 7.3 Social cognition intervention programs (continued).

Intervention for deficit in recognition emotional prosody (McDonald et al., 2013)	Emotional Processing	Traumatic Brain Injury	3 session /1 hour
SocialVille (Nahum et al., 2014)	Emotional Processing Social Knowledge Theory of Mind	Schizophrenia Spectrum Disorder	24 hour
Emotion recognition training (Neumann et al., 2015)	Emotional Processing	Traumatic Brain Injury	9 session /1 hour
E-motional Training (Vázquez-Campo et al., 2016)	Complete Social Cognition	Schizophrenia Spectrum Disorder	12 hour
Treatment for Impairments in Social Cognition and Emotions Regulations (T-ScEmo) (Westerhof-Evers et al., 2017)	Emotional Processing Social Knowledge Theory of Mind	Traumatic Brain Injury	20 session /1 hour
Computerized social cognition traning (Rodriguez-Rajo et al. 2022)	Complete Social Cognition	Traumatic Brain Injury	21 session /1 hour

"El ayer es historia, el mañana es un misterio, el hoy es un regalo, por eso se llama presente."

Maestro Oogway, Kung Fu Panda

8

Discusión general, conclusiones y perspectivas futuras

8.1 Discusión general

El objetivo general de esta Tesis Doctoral ha sido aportar herramientas y evidencias de su utilidad para el abordaje de la cognición social (CS) en niños, adolescentes y adultos con daño cerebral adquirido (DCA). Este proyecto de tesis surgió para abordar dos necesidades fundamentales en el ámbito de la investigación sobre la CS. En primer término, la carencia de pruebas validadas para evaluar componentes específicos de esta capacidad en una franja etaria de población infantil española. En segundo lugar, la escasez de intervenciones dirigidas a paliar los déficits en CS de las personas con DCA. Para dar respuesta a la primera necesidad se realizó el

primer estudio con el objetivo de validar una escala que permitiera llevar a cabo un screening del estado de adquisición de la ToM en infantes desde los 3 hasta los 7 años. En respuesta a la segunda necesidad se llevaron a cabo el segundo y tercer estudio, donde se diseñaron y se determinó la eficacia de dos programas de rehabilitación para mejorar los déficits en CS de personas con DCA.

En lo que respecta al primer estudio, se emplearon ítems previamente utilizados por destacados autores en investigaciones sobre la ToM (Wellman et al., 2006; Wellman & Liu, 2004). Estos ítems se organizaron en un formato estandarizado, siendo reunidos y ajustados con el propósito de que fueran apropiados y poder ser válidos para la población española. En este proceso, se tuvieron en cuenta aspectos culturales y lingüísticos para garantizar la comprensión y pertinencia de las preguntas y de los materiales para las personas en España. Para poner en formato estandarizado ítems de laboratorio se siguió el mismo procedimiento que ya previamente habían aplicado autores del equipo responsable de esta tesis (Carmona-Perera et al., 2015).

Para validar la escala se realizó un estudio que analizó la jerarquía de adquisición de cada uno de los ítems. Posteriormente, se comparó el orden evolutivo de adquisición de los ítems de los niños/as españoles con los publicados de otras culturas. Se observó que, aunque existían similitudes en algunos ítems, el ritmo de adquisición en otros era diferente, avalando que existe una influencia cultural en el ritmo de adquisición de los hitos que componen la ToM en la infancia (Molina et al., 2014; Shahaeian et al., 2011). Cabe destacar que, estos resultados coinciden con la investigación realizada por Wellman et al. (2006) y Koelkebeck et al. (2017), quienes demostraron que el orden de adquisición de los ítems de la ToM difería entre las culturas china y estadounidense. Estas diferencias se atribuyen a la influencia de valores culturales específicos que se inculcan desde temprana edad en cada sociedad.

Como resultado del estudio, se logró desarrollar la escala de evaluación denominada ToMas-child. Esta escala demuestra ser un instrumento unidimensional y válido para la identificación temprana de todos los hitos principales que conforman la ToM en el rango de edades comprendido entre los 3 y 7 años. Además, la ToMas-child es una escala gratuita, con versión tanto en inglés como en español, que va acompañada por material complementario dónde se detalla todo lo necesario para su administración y corrección. Esta escala, adaptada para infantes españoles, podría

ser utilizada por los propios profesionales de la educación debido a su brevedad y facilidad de implementación (todo detallado en el material complementario).

Dotar a los docentes de herramientas de screening de la ToM significa situar las herramientas en el lugar adecuado, permitiendo que sean ellos quienes lideren la detección precoz de manera operativa y a gran escala. Esta medida adquiere una relevancia destacada debido a la influencia directa que tiene la ToM en el rendimiento académico (Lecce et al., 2017). El desarrollo adecuado de la ToM facilita las relaciones tanto con profesores como con compañeros (Hughes & Leekam, 2004; Ronchi et al., 2020), promueve el desarrollo de las funciones ejecutivas (Austin et al., 2014) y estimula la participación activa en el proceso de aprendizaje (Graziano et al., 2007; Pekrun & Linnenbrink-Garcia, 2014), factores claves para el éxito académico.

Por otro lado, la escuela se configura como un entorno donde niños y adolescentes mantienen interacciones continuas con sus compañeros y maestros. Esta dinámica posibilita que los educadores comparen el avance de los estudiantes con sus iguales (Fayzullaeva, 2020). Además, dado el considerable tiempo que comparten, los docentes y el personal escolar están en posición de identificar patrones de comportamiento inusuales o dificultades en las interacciones sociales (O'Grady & Nag, 2022) posibilitando así una detección precoz de un déficit en esta capacidad.

A menudo, se encuentran carencias en ToM en niños que podrían ser o ya han sido diagnosticados con Trastorno del Espectro Autista, Trastorno por Déficit de Atención e Hiperactividad o DCA (Shantz, 1975). Sin embargo, la adquisición de la ToM durante la infancia es un proceso continuo que puede estar acelerado o enlentecido por múltiples factores como las interacciones adecuadas con otros, la convivencia con hermanos o el grado de desarrollo del lenguaje (Adams et al., 2005; Howe et al., 2011). Cuando no se lleva a cabo una detección temprana, los impactos negativos de un déficit prolongado en la adquisición en ToM se extienden a lo largo de la adolescencia y la vida adulta (Repacholi et al., 2003). La ToMas-child permite la evaluación temprana de todos los hitos evolutivos de la ToM, lo que posibilita la implementación de distintas opciones de intervención para evitar dificultades o reducir alteraciones relacionadas con el procesamiento, la comprensión y la adecuación de las interacciones sociales (Amsterlaw et al., 2009). La implementación oportuna de intervenciones y apoyos adecuados de forma temprana dirigidos a los

componentes de la CS mejorará la vida social de las personas afectadas y, en definitiva, su calidad de vida (Roelofs et al., 2017).

El segundo y tercer estudio de esta tesis doctoral han tenido como objetivo diseñar y determinar la eficacia de dos programas de rehabilitación para mejorar los déficits en CS de personas con DCA.

En relación al segundo estudio, los resultados de un diseño experimental de caso único mostraron la eficacia de aplicar una metodología individualizada para modificar conductas específicas alteradas tras un DCA por un déficit en CS. Esta metodología se caracteriza por considerar las necesidades y particularidades individuales y familiares, en consecuencia, todas las intervenciones se personalizan de manera específica para cada persona (Tate & Perdices, 2018). Para ello, en el presente estudio se desarrolló un programa de rehabilitación personalizado en base a ejercicios destinados a rehabilitar los componentes de la CS alterados que subyacían a los tres comportamientos deficitarios del participante. Las mediciones de resultado se tomaron durante las interacciones llevadas a cabo por la persona en su vida cotidiana en el colegio y en casa. Con esta metodología se abordó uno de los desafíos fundamentales identificados por Vallat-Azouvi et al. (2019), quienes establecieron que el objetivo último de la rehabilitación radicaba en lograr la generalización de los efectos en el entorno real de la persona.

Por otro lado, en el tercer estudio se utilizó un diseño pre-post dónde se elaboró el programa de rehabilitación SocialMind que incluía de forma holística todos los componentes de la CS y cuyas medidas de resultado fueron las puntuaciones obtenidas en una evaluación repetida pre-post con instrumentos estandarizados para cada componente de la CS. Los resultados mostraron que el programa de rehabilitación es efectivo para mejorar de forma significativa el reconocimiento emocional, el conocimiento social y la empatía; y lograr una mejora cercana a la significación de la ToM en personas con DCA. Además, los tamaños del efecto en todos los cambios logrados fueron grandes. Las magnitudes de los cambios son destacables teniendo en cuenta que como medidas se utilizaron pruebas de ejecución en las que se plantean situaciones y se debe responder en función de lo que se ha comprendido sobre las intenciones, emociones y causas de los comportamientos de los demás. Este tipo de instrumentos permite que, aunque no se haya medido la generalización a situaciones de la vida cotidiana, los participantes hayan sido

expuestos a situaciones sociales realistas que requieren la puesta en marcha de sus habilidades de interpretación de las mismas. Además, los test incorporaron preguntas de control para garantizar la comprensión del lenguaje y del contexto de la situación, así como la atención y la memoria de la persona evaluada cumplieran los requisitos necesarios para poder considerar que sus respuestas ante la parte de CS de los ítems fuesen válidas. Este tipo de evaluación da sentido a una interpretación en términos de significación clínica de los tamaños del efecto, que al ser grandes pueden considerarse indicadores de mejoras apreciables en la persona, no sólo estadísticas (Cohen, 1988).

Al comparar los resultados con los de otros programa de rehabilitación que han mostrado eficacia para mejorar los déficits en CS, destaca el hecho de que todos se enfocan en entrenar uno o dos componentes (Cassel et al., 2016; Darling et al., 2021; Loubat et al., 2019) mientras que el programa SocialMind incluye un módulo para cada uno de los cuatro componentes principales de la CS. Este enfoque integral representa una ventaja para los pacientes con DCA, ya que según el metaanálisis de Adams et al. (2019), una mayoría de ellos sufren déficits en tres de los cuatro componentes de esta habilidad. SocialMind cubre la necesidad que había de desarrollar programas de rehabilitación que aborden la CS en su totalidad. Los estudios muestran que más del 50 % de las personas con DCA presentan déficit en CS (Kelly et al., 2017). Contar con programas de rehabilitación específicos para mejorar la CS en individuos con DCA es crucial para garantizar su adecuada integración social (Frith, 2008) debido a las graves repercusiones de las alteraciones de la CS, que van desde una baja participación social y dificultades de integración social (Binder et al., 2019) y laboral (Yeates et al., 2016) hasta el completo aislamiento social (Spikman et al., 2012), y a los que hay que añadir la reducción de la calidad de vida de sus cuidadores (Bivona et al., 2015).

Los profesionales llevan tiempo manifestando que los programas específicamente diseñados para abordar las deficiencias en CS tras el DCA son insuficientes y que esa carencia se traduce en la falta de inclusión de la CS en los procesos de rehabilitación (Kelly et al., 2017). Los dos programas diseñados en esta Tesis Doctoral aportan opciones de intervención desde enfoques diferentes. Por un lado, el programa individualizado, diseñado para modificar directamente unas conductas objetivo que unos padres consideran prioritarias para la adaptación social de su hijo. La utilización de un diseño experimental de caso único para mostrar la eficacia de una intervención

de estas características ya ha tenido lugar en varios estudios previos en CS tras un DCA (Binder et al., 2019; Jacobson & Truax, 1992; Peyroux & Franck, 2016, 2016). En los otros casos publicados en las que se implementaron programas enfocados a componentes particulares de la CS con el propósito de modificar comportamientos específicos, las mediciones de resultado no se basaron en interacciones realizadas por la persona sino en ejercicios diseñados para cuantificar la cantidad de aciertos relacionados con el componente específico de la CS que estaba siendo trabajado (por ejemplo, Vassallo y Douglas, 2021). La evidencia de la eficacia de esta aproximación basada en un programa personalizado cuyos resultados son medidos a través de conductas reales que la persona lleva a cabo en su contexto habitual podría resultar de gran utilidad para que los profesionales incorporen la intervención en CS en sus pacientes con DCA que la requieran. La publicación realizada (Rivas-García et al., 2023) incorpora en su material complementario los ejercicios diseñados en la intervención para ese caso concreto, algo infrecuente en la literatura en este campo pero que podría ser de utilidad como elemento motivador y guía para llevar a cabo el proceso de individualizar la intervención en otros casos.

El programa de caso único ha incorporado actividades de rehabilitación tan sólo para los componentes de la CS implicados en las conductas objetivo. Sin embargo, el programa de intervención SocialMind del tercer estudio se ha diseñado desde una aproximación diferente. En vez de ser individualizado se han seleccionado actividades para la rehabilitación de los cuatro grandes componentes para ofrecer un formato de intervención estandarizada. En el manuscrito preparado para la publicación en formato de artículo se han puesto ejemplos de actividades de cada uno de los módulos correspondientes a los cuatro componentes, pero el programa completo se ha redactado en formato de manual para ser publicado y que esté accesible para el máximo número posible de profesionales.

En el presente, pese a la escasa disponibilidad de programas integrales para la rehabilitación de la CS tras un DCA que los profesionales pueden emplear (Kelly et al., 2017), y que esta restricción es aún más notable en el contexto de España, a nivel internacional, destaca el programa denominado "Reading a Smile and Other Great Expressions" (Bornhofen & McDonald, 2010). Este programa ha demostrado ser eficaz en la mejora del procesamiento emocional a lo largo de 16 sesiones de 90 minutos. De manera similar, el programa "Treatment for Impairments in Social

Cognition and Emotions Regulations" (T-ScEmo) (Westerhof-Evers et al., 2017) aborda exitosamente tanto el procesamiento emocional como la Teoría de la Mente (ToM). Sin embargo, no se evidencian mejoras en el conocimiento social ni en la empatía.

En el contexto de España, el programa "Computerized Social Cognitive Training" (Rodriguez-Rajo et al., 2022) es el único programa de rehabilitación específicamente diseñado para abordar la rehabilitación de la CS en personas que con DCA. Este programa consta de 21 sesiones de una hora cada una. A pesar de que su enfoque abarcaba todos los elementos de la CS, los resultados reflejaron que las mejoras significativas en comparación con el grupo de control se limitaron a la ToM.

En este panorama, el programa SocialMind ha mostrado su eficacia para mejorar tres de los componentes claves de la CS: procesamiento emocional, conocimiento social y empatía. Además, los resultados obtenidos en relación con la ToM muestran una proximidad notable a la significación estadística. La coherencia de estos resultados respalda con solidez la efectividad y el potencial del programa SocialMind en la rehabilitación de la CS después de un DCA.

Con la realización de estos dos estudios, se proporcionan a los profesionales resultados eficaces de dos enfoques distintos, permitiéndoles evaluar qué metodología podría ser más adecuada según las circunstancias, incluido el contexto del caso. Además, se presentan dos programas de rehabilitación completos junto con sus materiales, lo que aborda uno de los principales problemas en la rehabilitación de la CS en personas con DCA: la carencia de intervenciones específicamente dirigidas a esta población (Cassel et al., 2016; Loubat et al., 2019).

8.1.1 Implicaciones de los resultados de la Tesis

El primer estudio de esta tesis (Rivas-Garcia et al., 2020) tiene implicaciones tanto prácticas como teóricas. La ToMas-child emerge como una herramienta de gran utilidad: es breve, estandarizada, de acceso gratuito, fácil de aplicar y válida para evaluar el desarrollo de la ToM desde edades tempranas. Este método de evaluación se adapta eficazmente a un uso extendido en entornos escolares, donde la información sobre el avance de la ToM resulta esencial para asegurar la integración social y el desarrollo continuo de cada individuo. Además, la ToMas-child también posibilita la

comparación de los procesos de adquisición de la ToM en niños españoles con sus contrapartes de otras culturas, ya que cinco de sus pruebas se emplean actualmente en investigaciones multinacionales (por ejemplo, Kuntoro, Peterson y Slaughter, 2017).

Desde un enfoque teórico, el análisis de Rasch señaló que no sería conveniente añadir la tarea de Sally-Anne a las escalas que ya contienen un ítem sobre la evaluación de creencias falsas. La escala central de la ToMas-child constituye una herramienta unidimensional de medición de la ToM, enriqueciendo la escala de 5 ítems de ToM de Wellman y Liu (2004, 2006) al incorporar habilidades para (a) comprender que la propia mente y la de los demás albergan deseos, pensamientos (incluidas creencias falsas de contenido) y emociones diversas, y (b) formular hipótesis acerca de cómo operan las mentes y responden a eventos tanto internos como externos (Lieberman, 2007).

Los otros dos estudios de esta tesis dan respuesta a unos de los retos fundamentales en la rehabilitación de la CS en personas con DCA: la falta de programas específicos para esta población (Kelly et al., 2017).

Por un lado, en relación a las implicaciones del segundo estudio (Rivas-García et al., 2023), los resultados enfatizan la eficacia de la metodología de diseño de caso único en las intervenciones destinadas a mejorar comportamientos específicos derivados de un déficit en la CS. Además, se facilita a los profesionales la información sobre los tres programas implementados, junto con los detalles de las puntuaciones obtenidas en la "Risk of Bias in Trials Scale N of 1 (RoBiNT)" (2015) y en la "Single-Case Reporting Guidelines for Behavioural Interventions (SCRIBE)" (2016), para permitir una replicación sencilla del estudio.

Por otro lado, en relación al tercer estudio, se validó la eficacia del programa de rehabilitación denominado SocialMind, el cual se diseñó con el propósito de mejorar los cuatro componentes principales de la CS en personas con DCA. Los resultados demostraron mejoras significativas en el reconocimiento emocional, el conocimiento social, la empatía y aproximaciones significativas en la ToM. Este programa, accesible para los profesionales, destaca por abordar las limitaciones de otros programas al enfocarse en múltiples componentes de la CS.

Ambos estudios aportan a los profesionales opciones de intervención efectivas y programas de rehabilitación completos. El enfoque personalizado y el programa SocialMind abordan diversas necesidades y contextos. Brindar intervenciones

dirigidas a la CS en personas con DCA es esencial para mejorar la inclusión social y la calidad de vida, dadas las implicaciones significativas de las deficiencias en CS en diferentes aspectos de la vida. Estos estudios contribuyen a abordar la carencia de programas específicos de rehabilitación en este campo y ofrecen recursos valiosos para los profesionales.

En resumen, esta tesis doctoral proporciona herramientas de evaluación y programas de rehabilitación para abordar los déficits en CS en personas con DCA. Los resultados tienen implicaciones importantes para la detección temprana, la intervención y la mejora de la calidad de vida en esta población.

8.2 Conclusiones

Como resultado de la presente Tesis Doctoral, se pueden derivar las siguientes conclusiones:

1. El desarrollo de la ToM se ve influenciado tanto por la cultura como por la edad.

2. La escala ToMas-child se configura como un enfoque unidimensional con una sólida validez de construcción para la evaluación de la ToM en niños de edades comprendidas entre 3 y 7 años.

3. El diseño experimental de caso único demuestra ser apropiado para la rehabilitación de CS en individuos afectados por DCA.

4. Los programas de rehabilitación desarrollados en el estudio con metodología de caso único muestran su eficacia al reducir comportamientos problemáticos e incrementar conductas socialmente adecuadas.

5. El programa SocialMind introduce un enfoque valioso e innovador para la mejora de la CS en personas con DCA al incluir ejercicios para trabajar los cuatros componentes principales de la CS: procesamiento emocional, conocimiento social, ToM y empatía.

6. El programa SocialMind ha demostrado ser efectivo en la mejora de las deficiencias en tres de los componentes de la Competencia Social resultantes de un DCA.

7. El programa SocialMind posibilita la rehabilitación efectiva del paciente en su hogar, guiada y supervisada por el terapeuta a través del seguimiento online.

8.3 Perspectivas futuras

De la siguiente Tesis Doctoral se derivan las siguientes perspectivas futuras:

- Realizar una investigación ampliando la muestra de esta tesis y empleando la escala ToMas-child en un contexto escolar que englobe tanto áreas urbanas como rurales. El propósito de este estudio es verificar la extrapolación de los resultados obtenidos en esta tesis a la población general española y establecer la secuencia de desarrollo de los ítems de la ToM en dicha población.

- Explorar y analizar el impacto de la cultura en el desarrollo de la ToM mediante la realización de estudios interculturales. La flexibilidad comparativa de la escala ToMas-child podría facilitar la evaluación de diferentes contextos culturales y su influencia en el desarrollo de esta habilidad.

- Realizar investigaciones utilizando un diseño de metodología de caso único que incorpore más fases, con el fin de examinar y validar la efectividad de los programas de rehabilitación propuestos.

- Evaluar de manera más amplia la aplicación del programa de rehabilitación SocialMind, con el objetivo de confirmar los resultados obtenidos y su viabilidad en un espectro más amplio.

- Aplicar el programa de rehabilitación SocialMind en otras poblaciones, a fin de verificar su adaptabilidad y efectividad en diferentes contextos, ampliando así su utilidad y alcance.

"Toda una vida me estaría contigo
No me importa en que forma Ni como, ni donde, pero junto a ti."

Antonio Machín

9

General discussion, conclusions, and future perspectives

9.1 General discussion

The overall goal of this doctoral thesis has been to provide tools and evidence of their usefulness for addressing social cognition (SC) in children, adolescents, and adults with acquired brain injury (ABI). This thesis project emerged to address two fundamental needs in the field of SC research. Firstly, the lack of validated tests to assess specific components of this capacity within a certain age range of the Spanish child population. Secondly, the scarcity of interventions aimed at mitigating SC deficits in individuals with ABI. To address the first need, the first study was conducted with the aim of validating a scale that would allow for screening the

acquisition status of Theory of Mind (ToM) in infants aged 3 to 7 years. In response to the second need, the second and third studies were carried out, designing and determining the effectiveness of two rehabilitation programs to improve SC deficits in individuals with ABI.

In the first study, items previously used by prominent authors in ToM research (Wellman et al., 2006; Wellman & Liu, 2004) were employed. These items were organized in a standardized format, collected and adjusted to be appropriate and valid for the Spanish population. In this process, cultural and linguistic aspects were taken into account to ensure the comprehension and relevance of the questions and materials for individuals in Spain. The same procedure used by authors from the team responsible for this thesis (Carmona-Perera et al., 2015) was followed to standardize lab items. To validate the scale, a study was conducted analyzing the acquisition hierarchy of each item. Subsequently, the developmental order of acquisition of the Spanish children's items was compared with those published from other cultures. It was observed that while there were similarities in some items, the pace of acquisition in others was different, supporting the idea that there is a cultural influence on the acquisition pace of the milestones that compose ToM in childhood (Molina et al., 2014; Shahaeian et al., 2011). It's worth noting that these results coincide with research conducted by Wellman et al. (2006) and Koelkebeck et al. (2017), who demonstrated that the order of item acquisition differed between Chinese and American cultures. These differences are attributed to the influence of specific cultural values that are instilled from an early age in each society.

As a result of the study, the evaluation scale named ToMas-child was developed. This scale proves to be a one-dimensional and valid instrument for the early identification of all major milestones that make up ToM in the age range of 3 to 7 years. Furthermore, ToMas-child is a free scale, available in both English and Spanish versions, accompanied by supplementary material detailing everything necessary for its administration and correction. This scale, adapted for Spanish infants, could be used by education professionals due to its brevity and ease of implementation (all detailed in the supplementary material). Providing teachers with ToM screening tools means placing the tools in the right place, allowing them to take the lead in early detection in an operational and large-scale manner. This measure is of significant relevance due to the direct influence that ToM has on academic performance (Lecce et

al., 2017). The proper development of ToM facilitates relationships with both teachers and peers (Hughes & Leekam, 2004; Ronchi et al., 2020), promotes executive function development (Austin et al., 2014), and encourages active participation in the learning process (Graziano et al., 2007; Pekrun & Linnenbrink-Garcia, 2014), key factors for academic success.

On the other hand, school serves as an environment where children and adolescents engage in continuous interactions with their peers and teachers. This dynamic enables educators to compare students' progress with their peers (Fayzullaeva, 2020). Furthermore, given the considerable time they spend together, teachers and school personnel are positioned to identify unusual behavioral patterns or difficulties in social interactions (O'Grady & Nag, 2022), enabling early detection of a deficit in this capacity.

Often, deficits in ToM are found in children who may be or have already been diagnosed with Autism Spectrum Disorder, Attention Deficit Hyperactivity Disorder, or ABI (Shantz, 1975). However, the acquisition of ToM during childhood is a continuous process that can be accelerated or slowed down by multiple factors such as appropriate interactions with others, living with siblings, or the level of language development (Adams et al., 2005; Howe et al., 2011). When early detection is not carried out, the negative impacts of a prolonged deficit in ToM acquisition extend into adolescence and adulthood (Repacholi et al., 2003). ToMas-child enables the early assessment of all developmental milestones of ToM, enabling the implementation of various intervention options to prevent difficulties or reduce alterations related to the processing, understanding, and adequacy of social interactions (Amsterlaw et al., 2009). The timely implementation of early appropriate interventions and supports targeting SC components will improve the social life of affected individuals and ultimately their quality of life (Roelofs et al., 2017).

The second and third studies in this doctoral thesis aimed to design and determine the effectiveness of two rehabilitation programs to improve SC deficits in individuals with ABI.

Regarding the second study, the results of a single-case experimental design demonstrated the efficacy of applying an individualized methodology to modify specific behaviors altered due to SC deficits following ABI. This methodology considers individual and family needs and specificities, hence all interventions are

tailored specifically for each individual (Tate & Perdices, 2018). For this purpose, a personalized rehabilitation program was developed based on exercises designed to rehabilitate the altered SC components underlying the participant's three deficit behaviors. Outcome measurements were taken during interactions carried out by the individual in their daily life at school and at home. With this methodology, one of the fundamental challenges identified by Vallat-Azouvi et al. (2019) was addressed, who established that the ultimate goal of rehabilitation was to achieve the generalization of effects in the individual's real environment.

On the other hand, in the third study, a pre-post design was used to develop the SocialMind rehabilitation program that holistically included all components of SC. The outcome measures were scores obtained from a repeated pre-post evaluation using standardized instruments for each SC component. The results showed that the rehabilitation program is effective in significantly improving emotional recognition, social knowledge, and empathy, and achieving an improvement close to statistical significance in ToM for individuals with ABI. Moreover, the effect sizes for all achieved changes were large. The magnitudes of these changes are noteworthy considering that performance measures were used, where situations are presented, and responses are given based on what has been understood about others' intentions, emotions, and causes of behavior (Cohen, 1988).

Comparing the results with those of other rehabilitation programs that have shown effectiveness in improving SC deficits, it stands out that all focus on training one or two components (Cassel et al., 2016; Darling et al., 2021; Loubat et al., 2019), while the SocialMind program includes a module for each of the four main components of SC. This comprehensive approach is an advantage for ABI patients, as according to the meta-analysis by Adams et al. (2019), the majority of them suffer deficits in three of the four components of this skill. SocialMind fills the need to develop rehabilitation programs that address SC comprehensively. Studies show that over 50 % of people with ABI have SC deficits (Kelly et al., 2017). Having specific rehabilitation programs to improve SC in individuals with ABI is crucial to ensure their proper social integration (Frith, 2008) due to the significant repercussions of SC impairments, ranging from low social participation and social integration difficulties (Binder et al., 2019) and employment issues (Yeates et al., 2016) to complete social

isolation (Spikman et al., 2012), along with the reduced quality of life for caregivers (Bivona et al., 2015).

Professionals have long been expressing that programs specifically designed to address SC deficiencies after ABI are insufficient, and this deficiency translates into the lack of inclusion of SC in rehabilitation processes (Kelly et al., 2017). The two programs designed in this Doctoral Thesis provide intervention options from different approaches. On one hand, the personalized program, designed to directly modify target behaviors that parents consider priorities for their child's social adaptation. The use of a single-case experimental design to demonstrate the effectiveness of an intervention of this nature has already been done in several previous studies in SC following ABI (Binder et al., 2019; Jacobson & Truax, 1992; Peyroux & Franck, 2016, 2016). In the other published cases where programs focused on specific components of SC were implemented to modify specific behaviors, outcome measurements were not based on interactions carried out by the individual but rather on exercises designed to quantify the number of correct responses related to the specific SC component being worked on (e.g., Vassallo & Douglas, 2021). The evidence of the effectiveness of this personalized program-based approach, with results measured through real behaviors that the individual engages in their usual context, could be highly useful for professionals to incorporate SC intervention in their ABI patients who require it. The published work (Rivas-García et al., 2023) includes exercises designed for that specific intervention case in the supplementary material, something unusual in the literature in this field but could serve as a motivating element and guide for individualizing the intervention process in other cases.

The single-case program has incorporated rehabilitation activities only for the SC components involved in the target behaviors. However, the SocialMind intervention program in the third study has been designed from a different approach. Instead of being individualized, activities were selected to rehabilitate all four major components in order to provide a standardized intervention format. The manuscript prepared for publication in article format provides examples of activities for each module corresponding to the four components, but the full program has been written in a manual format for publication and to be accessible to as many professionals as possible.

Currently, despite the limited availability of comprehensive programs for SC rehabilitation following ABI that professionals can employ (Kelly et al., 2017), which is even more notable in the context of Spain, internationally, the program "Reading a Smile and Other Great Expressions" (Bornhofen & McDonald, 2010) stands out. This program has proven effective in improving emotional processing over 16 sessions of 90 minutes. Similarly, the "Treatment for Impairments in Social Cognition and Emotions Regulations" (T-ScEmo) program (Westerhof-Evers et al., 2017) successfully addresses both emotional processing and ToM. However, no improvements are evident in social knowledge or empathy.

In the context of Spain, the "Computerized Social Cognitive Training" program (Rodriguez-Rajo et al., 2022) is the only rehabilitation program specifically designed to address SC rehabilitation in people with ABI. This program consists of 21 one-hour sessions each. Although its focus encompassed all SC elements, the results reflected that significant improvements compared to the control group were limited to ToM.

In this scenario, the SocialMind program has demonstrated its effectiveness in improving three key components of SC: emotional processing, social knowledge, and empathy. Furthermore, the results obtained regarding ToM show a notable proximity to statistical significance. The consistency of these results strongly supports the effectiveness and potential of the SocialMind program in SC rehabilitation following ABI.

With the completion of these two studies, effective results from two different approaches are provided to professionals, allowing them to assess which methodology might be more suitable depending on circumstances, including the case context. Furthermore, two comprehensive rehabilitation programs are presented along with their materials, addressing one of the main issues in SC rehabilitation in people with ABI: the lack of interventions specifically targeted to this population (Cassel et al., 2016; Loubat et al., 2019).

9.1.1 Implications of Thesis Results

The first study of this thesis (Rivas-Garcia et al., 2020) has both practical and theoretical implications. ToMas-child emerges as a highly useful tool: it is brief, standardized, freely accessible, easy to administer, and valid for assessing ToM

development from an early age. This evaluation method effectively adapts to widespread use in school environments, where information about ToM progress is essential to ensure social integration and the continuous development of each individual. Additionally, ToMas-child also allows for the comparison of ToM acquisition processes in Spanish children with their counterparts from other cultures, as five of its tests are currently used in multinational research (e.g., Kuntoro, Peterson & Slaughter, 2017).

From a theoretical perspective, the Rasch analysis indicated that adding the Sally-Anne task to scales that already contain an item on false belief assessment would not be advisable. The core ToMas-child scale constitutes a one-dimensional measurement tool for ToM, enriching Wellman and Liu's 5-item ToM scale by incorporating skills to (a) understand that one's own mind and the minds of others harbor desires, thoughts (including false beliefs of content), and diverse emotions, and (b) hypothesize how minds operate and respond to both internal and external events (Lieberman, 2007).

The other two studies in this thesis address one of the fundamental challenges in SC rehabilitation for people with ABI: the lack of specific programs for this population (Kelly et al., 2017).

On one hand, concerning the implications of the second study (Rivas-Garcia et al., 2023), the results emphasize the effectiveness of the single-case design methodology in interventions aimed at improving specific behaviors stemming from SC deficits. Additionally, information about the three implemented programs is provided to professionals, along with details of the scores obtained on the "Risk of Bias in Trials Scale N of 1 (RoBiNT)" (2015) and the "Single-Case Reporting Guidelines for Behavioral Interventions (SCRIBE)" (2016), to allow for easy replication of the study.

On the other hand, regarding the third study, the effectiveness of the rehabilitation program called SocialMind was validated, which was designed with the purpose of improving the four main components of SC in people with ABI. The results demonstrated significant improvements in emotional recognition, social knowledge, empathy, and close-to-significant improvements in ToM. This program, accessible to professionals, stands out for addressing the limitations of other programs by focusing on multiple SC components.

Both studies provide professionals with effective intervention options and comprehensive rehabilitation programs. The personalized approach and the SocialMind program address various needs and contexts. Providing interventions targeted at SC in people with ABI is essential for improving social inclusion and quality of life, given the significant implications of SC deficiencies in different aspects of life. These studies contribute to addressing the lack of specifically targeted rehabilitation programs in this field and offer valuable resources for professionals.

In summary, this doctoral thesis provides assessment tools and rehabilitation programs to address SC deficits in people with ABI. The results have important implications for early detection, intervention, and improving quality of life in this population.

9.2 Conclusions

As a result of this Doctoral Thesis, the following conclusions can be drawn:

1. The development of ToM is influenced by both culture and age.
2. The ToMas-child scale is established as a unidimensional approach with solid construct validity for assessing ToM in children aged 3 to 7 years.
3. The single-case experimental design proves suitable for the rehabilitation of SC in individuals affected by ABI.
4. The rehabilitation programs developed in the single-case study demonstrate effectiveness in reducing problematic behaviors and increasing socially appropriate behaviors.
5. The SocialMind intervention program introduces a valuable and innovative approach to improving SC in people with ABI by including exercises to work on all four major SC components: emotional processing, social knowledge, ToM, and empathy.
6. The SocialMind program has demonstrated effectiveness in improving three of the key components of SC resulting from ABI.

7. The SocialMind program enables effective patient rehabilitation at home, supervised by the therapist through online monitoring.

9.3 Future Perspectives

The following future perspectives can be derived from this Doctoral Thesis:

- Conduct research by expanding the sample of this thesis and using the ToMas-child scale in a school context that encompasses both urban and rural areas. The purpose of this study is to verify the extrapolation of the results obtained in this thesis to the general Spanish population and establish the sequence of development of ToM items in that population.
- Explore and analyze the impact of culture on ToM development by conducting cross-cultural studies. The comparative flexibility of the ToMas-child scale could facilitate the evaluation of different cultural contexts and their influence on the development of this ability.
- Conduct research using a single-case methodology design that incorporates more phases in order to examine and validate the effectiveness of the proposed rehabilitation programs.
- More broadly evaluate the application of the SocialMind rehabilitation program to confirm the results obtained and its feasibility in a broader spectrum.
- Apply the SocialMind rehabilitation program to other populations in order to verify its adaptability and effectiveness in different contexts, thereby expanding its usefulness and scope.

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