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Avances en el estudio de la impulsividad y la regulación emocional en el juego de azar: Investigaciones con muestra española y ecuatoriana.

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Advancements in the study of the impulsivity and emotional regulation in gambling disorder: Studies with Spanish and Ecuadorian samples

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RESUMEN

El trastorno por juego de azar (TJA) se caracteriza por una alteración progresiva del comportamiento de juego, en la que el individuo presenta deseos incontrolables y persistentes por jugar a pesar de las consecuencias negativas (p. ej., problemas económicos, familiares, laborales por causa del juego de azar). Actualmente es reconocido como un trastorno mental en el Manual Diagnóstico y Estadístico de Enfermedades Mentales (DSM 5; APA, 2013), y en la Clasificación Internacional de Enfermedades (CIE 11; OMS, 2019). De acuerdo con una revisión sistemática, el TJA afecta entre el 0.1 y 3.4% de la población europea, y entre el 0.1 y 6% en poblaciones de otros países del mundo (Calado y Griffiths, 2016). Sin embargo, se presume que las tasas de prevalencia están en aumento, debido a que la globalización ha generado nuevas modalidades y vías de acceso al juego (p.ej., juegos de azar a través de internet o del teléfono móvil), y diferentes modalidades de pago o endeudamiento (tarjetas de crédito o de débito). Estos nuevos medios han permitido también el acceso al juego de azar de diferentes poblaciones para las que la mayor parte de modalidades presenciales son ilegales y los juegos de azar en línea no están regulados (p.ej., Ecuador).

La investigación sobre el TJA tiene una larga trayectoria. Muchos de estos estudios han sugerido que los efectos neurobiológicos y comportamentales del TJA son similares a los del trastorno por abuso de sustancias (Hodgins, Stea y Grant, 2011; Leeman y Potenza, 2012; Petry, 2010), aunque también se han descrito diferencias (Clark y cols., 2018). Entre los factores etiológicos más estudiados en relación a la vulnerabilidad y al curso del TJA están la impulsividad, la desregulación emocional y los sesgos cognitivos. Estos factores, de hecho, han sido incluidos en buena parte de los modelos teóricos en los que se intenta explicar el desarrollo y el mantenimiento del TJA. Por ejemplo, Blaszczynski y Nower (2002) proponían un modelo en el que el juego problemático está causado principalmente por mecanismos de condicionamiento (*jugadores condicionados*), pero en el que se describen dos subtipos de jugadores más, por la concurrencia de alteraciones del afecto (*jugadores emocionalmente vulnerables*), o de rasgos de impulsividad y problemas de conducta (*jugadores impulsivos-antisociales*). La evidencia posterior ha avalado esa relación, pero, al mismo tiempo, ha avanzado en la comprensión de la impulsividad y la regulación emocional como constructo multifactoriales (Evenden, 1992; John y Gross, 2004; Whiteside y Lynam 2001), y ha resaltado la importancia de la impulsividad de base afectiva como el origen de la relación entre la impulsividad y las diferencias individuales entre jugadores.

La impulsividad de base afectiva, la regulación emocional y los procesos en los que ambos constructos se solapan, se consideran por tanto factores cruciales para entender el TJA y las variaciones individuales entre jugadores, con o sin TJA. Recientemente, esa idea ha sido cristalizada en el *Modelo de Espacio de Juego* (*Gambling Space Model*, *GSM*; Navas y cols., 2019), que supone la base teórica de la presente tesis. En términos generales, el GSM es un modelo donde se intentan integrar los diversos constructos de la impulsividad de base afectiva, las estrategias de regulación emocional, los sesgos cognitivos y los componentes de reforzamiento, como variables que permiten explicar las diferencias individuales entre los jugadores de azar. El modelo está definido por cuatro dimensiones: (1) *sensibilidad a las propiedades apetitivas del juego*, relacionada con motivos recompensantes que tiene el individuo para jugar juego de azar, tanto por su propia sensibilidad individual general a la recompensa, como por las posibles características de la propia actividad de juego; (2) *sensibilidad a los componentes de reforzamiento negativo del juego*, por la que los individuos se ven motivados a jugar para calmar estados afectivos negativos; (3) *desregulación emocional generalizada*, que se reflejaría en la tendencia a comportarse de forma impulsiva en situaciones emocionales negativas; y (4) *elaboración cognitiva de autoengaño* referida a la tendencia a usar estrategias cognitivas elaboradas para justificar el juego y reducir su impacto. Como se detalla en secciones posteriores, de estas dimensiones, las dos primeras serían reflejo del uso de estrategias 'abiertas' de regulación emocional (mejoramiento y afrontamiento, respectivamente; ver Stewart y Zack, 2008), la cuarta reflejaría el uso de estrategias cognitivas encubiertas pero controladas (o *model-based*), y la tercera dependería de la alteración de mecanismos implícitos de regulación emocional (o *model-free*).

En este marco, el objetivo general de la presente tesis es avanzar en la comprensión del papel de las variables de impulsividad y de regulación emocional en el trastorno por juego de azar y los problemas derivados de él. Esta contribución se desarrolla a través de tres vías, que constituyen los tres capítulos centrales de esta tesis: a) extender la validez y relevancia clínica de las variables de interés a contextos más allá de los países occidentales desarrollados, b) el uso de tales variables, no de forma transversal, sino de forma longitudinal para predecir los resultados de la terapia psicológica para el TJA, y c) la exploración experimental, a través de tareas conductuales de toma de decisiones, de al menos parte de dichas variables, lo que debe servirnos de interfaz para conectar las manifestaciones conductuales del juego y sus bases neurocognitivas.

En el Capítulo 2, por tanto, se presenta un estudio transcultural con el que se intenta corroborar las relaciones ya conocidas entre los constructos de interés (impulsividad de base afectiva, regulación emocional y sesgos cognitivos relacionados con el juego) y las

manifestaciones conductuales y clínicas del trastorno por juego de azar en población ecuatoriana. Estas relaciones ya han sido reportadas anteriormente en muestras española e inglesa (ver; Del Prete y cols., 2017; Michalczuk, Bowden-Jones, Verdejo-García y Clark, 2011) y vienen predichas por el GSM. Puesto que el GSM es un modelo de inspiración psicobiológica, lo que se espera de este estudio es una réplica conceptual de dichas relaciones. Más concretamente, la primera hipótesis afirma que los sesgos cognitivos relacionados con el juego de azar están más estrechamente relacionados con los aspectos de impulsividad emocional que con sus facetas cognitivas. La segunda hipótesis establece que los sesgos cognitivos reflejan una reinterpretación de los eventos relacionados con el juego, o justificaciones de sentimientos y motivos, y que estos deben de estar asociados con el uso de estrategias de regulación emocional habitualmente consideradas como adaptativas, según la literatura (específicamente la reevaluación). En la tercera hipótesis, se predice que los signos de desregulación emocional *model-free*, medidos como urgencia negativa, deben estar relacionados con alteraciones más allá del juego de azar, en forma de comorbilidades afectivas y externalizantes.

En el Capítulo 3, se aborda el papel de las variables psicológicas que se encuentran involucradas en el abandono y en el cumplimiento terapéutico de los pacientes con TJA. La mayor parte de los estudios previos sobre esta relación no han diferenciado expresamente entre abandono, recaída y adherencia al tratamiento. Por ello, en este capítulo se presenta un estudio con muestra española, en el que se investigó el valor predictivo de la impulsividad, medida a través de la UPPS-P con respecto a la adherencia y al abandono terapéutico. En la línea de la investigación previa, se espera encontrar una relación inversa entre adherencia y variables que estén relacionados con motivos positivos para jugar (búsqueda de sensaciones), o con la presencia de desregulación emocional (urgencia positiva y negativa), tal y como se deriva de las dimensiones; *sensibilidad a los componentes de reforzamiento positivo* y *desregulación emocional generalizada* del modelo de espacio de juego. A este respecto, nuestra hipótesis es que estas variables probablemente afecten de forma directa a la motivación para dejar de jugar (p.ej., aspectos reforzantes del juego) y/o a la relación del jugador con su entorno social, que supone una fuente de apoyo y un predictor conocido de la continuidad y adherencia al tratamiento.

En el Capítulo 4, se presenta un estudio realizado con una muestra de pacientes en tratamiento por el uso de sustancias y que además presentaban trastorno por juego de azar, frente a otra de controles sanos ecuatorianos, en el que se explora la posibilidad de que la tarea Probabilística de Aprendizaje de Inversión Afectivo (*Affective Probabilistic Reversal Learning Task, PRLT*) pueda ser sensible a los mecanismos neurocognitivos que sustentan la impulsividad

de base afectiva. Este protocolo se categoriza como una tarea de *toma de decisiones bajo ambigüedad*, en la que el paciente tiene que adaptar dinámicamente sus decisiones a contingencias de reforzamiento previamente desconocidas, y en la que estas contingencias cambian a lo largo de la tarea. Esta tarea se ha utilizado principalmente para medir la inflexibilidad en el aprendizaje que sustenta la toma de decisiones. Modelos recientes de regulación emocional postulan que esa flexibilidad refleja la operación de mecanismos no intencionales de actualización del valor afectivo de las opciones de decisión (Damasio, 1994; Etkin y cols., 2015), y, por tanto, la PRLT podría capturar el funcionamiento de los mecanismos de regulación afectiva denominados automáticos o *model-free* (Braunstein y Gross, 2017). En relación a ello, nuestra hipótesis fundamental es que los pacientes muestran una menor capacidad para adaptar sus decisiones al cambio de contingencia, una vez que se ha establecido una preferencia determinada, y que este patrón está agravado por la presencia de signos de desregulación emocional generalizada, medida a través de la escala de urgencia negativa del UPPS-P. Y por otro lado, aporta mejoras metodológicas en el análisis de la PRLT, de cara a evitar la multiplicidad de análisis que se han visto hasta el momento en la literatura (van Timmeren, Daams, van Holst y Goudriaan, 2017), y que dificultan su interpretación. Aquí proponemos analizar las curvas completas de adquisición y readquisición ensayo a ensayo y se estima la sensibilidad de estas a las manipulaciones principales de la tarea (signo de la contingencia y ensayo de aprendizaje), así como a los predictores de interés teórico: grupo (pacientes frente a controles), urgencia negativa (medida a través de la UPPS-P), y la severidad en el juego de azar (medido con el SOGS).

Los resultados de los estudios que conforman esta tesis suponen un avance en la comprensión del TJA. En el estudio 1, descrito en el capítulo 2, se comprobó que las relaciones entre impulsividad emocional (medida con la UPPS-P), las estrategias de regulación emocional (ERQ), los sesgos cognitivos (GRCS), la severidad del juego (SOGS) y la presencia de problemas comórbidos con el uso de alcohol y drogas ilegales (MultiCAGE CAD-4) se aproximan mucho a las predicciones del modelo GSM. Se encontraron asociaciones de la severidad del juego de azar con la mayoría de los indicadores de impulsividad y de distorsiones cognitivas, así como con los problemas derivados del uso de alcohol y otras drogas, lo que muestra la relevancia de todas estas variables en la caracterización del TJA. Teóricamente más relevantes son las asociaciones (1) de la urgencia negativa con el uso de la supresión y (menos consistentemente), con los problemas con el alcohol; (2) de la búsqueda de sensaciones con el conjunto de distorsiones cognitivas del GRCS, y de la urgencia positiva, más específicamente, con los sesgos cognitivos del GRCS; y (3) del uso de la reevaluación con los sesgos cognitivos del GRCS. Este patrón de relaciones refuerza

la naturaleza motivacional-emocional de los sesgos cognitivos y su vinculación con las estrategias de regulación emocional que predice el GSM.

Los resultados del estudio 2, descrito en el capítulo 3, muestran que la impulsividad emocional es predictora de los resultados del tratamiento psicológico que siguen los pacientes con TJA. Por un lado, la urgencia positiva predice el abandono del tratamiento, mientras que una menor puntuación en la búsqueda de sensaciones predice una mayor adherencia al tratamiento. En relación a este último resultado, se halló también que una mayor conciencia del problema también contribuye a la adherencia al tratamiento.

Los resultados del estudio 3, descrito en el capítulo 4, muestran que la *Probabilistic Reversal Learning Task* puede medir más de un proceso relacionado con el juego de azar. Tanto el grupo de pacientes como los controles sanos tenían respuestas correctas que aumentaban con cada ensayo dentro de las fases. Sin embargo, el grupo de controles sanos alcanzó niveles más altos de aprendizaje (mayor número de decisiones correctas) al final de cada fase. Por otro lado, al analizar el rendimiento en la PRLT en relación al SOGS en el grupo de pacientes, se encontró que una mayor severidad por el juego de azar se asocia a una mayor inflexibilidad en el aprendizaje, esto es, a una menor eficiencia en la readquisición de preferencias en las fases de la tarea con contingencias invertidas. Del mismo modo, también se pudo observar que un incremento similar de la inflexibilidad asociada a la urgencia negativa. Estos efectos de la urgencia negativa y del SOGS en el desempeño de la PRLT son al menos parcialmente independientes. Este último resultado indica que, probablemente, la ejecución en la PRLT (reflejada como inflexibilidad en el aprendizaje) esté relacionada con procesos de regulación emocional incidental, pero que ello no explica en su totalidad su relación con la sintomatología del juego problemático.

Desde un punto de vista clínico, estos resultados permiten plantear la importancia de adaptar y complementar las actuales vías habituales de tratamiento. Primero, el entrenamiento de habilidades metacognitivas podría resultar beneficioso para los pacientes que usan estrategias de regulación emocional para justificar sus motivos y deseos de jugar y que, por tanto, alimentan los sesgos cognitivos asociados al juego de azar. Dicho entrenamiento iría encaminado a hacerles conscientes de la conexión entre sus creencias irracionales y sus motivos para jugar. Segundo, las técnicas de *mindfulness* integradas en la terapia cognitiva-conductual pudieran ser eficaces en el tratamiento de la desregulación emocional generalizada, y parecen tener eficacia en pacientes que presentan un déficit en la toma de decisiones afectivas. Tercero, los pacientes que muestren inflexibilidad en el aprendizaje, y otras alteraciones cognitivas independientes de dominio,

pudieran ser tratados con técnicas de entrenamiento de la función ejecutiva. Estas técnicas han demostrado tener eficacia en pacientes con trastornos por consumo de sustancias (Christiansen, Schoenmakers y Field, 2015). Y cuarto, los resultados apuntan la importancia de trabajar específicamente la ambivalencia motivacional en las primeras fases del tratamiento, mediante técnicas específicas, como la entrevista motivacional, especialmente en los perfiles de jugadores en los que, tal y como sugieren nuestros datos, dicha ambivalencia tiende a ser más intensa y a incrementar el riesgo de abandono y a disminuir la adherencia.

En relación a las posibles implicaciones transculturales, los estudios 1 y 3 sugieren que los constructos del GSM son consustanciales a la generación de variabilidad individual entre jugadores, y, por tanto, posiblemente generalizables a través de culturas. Por una parte, el patrón de correlaciones entre las variables estudiadas es muy similar a los previamente reportados para muestras españolas y británicas. Por otro, tal y como postula el modelo, se pudo comprobar en la muestra ecuatoriana una asociación de la inflexibilidad en el aprendizaje con un mayor nivel de urgencia negativa y con una mayor severidad del juego. Ello no implica que, necesariamente, la conducta de juego se manifieste de igual manera a través de contextos culturales. En concreto, y aunque no disponemos de datos comparativos directos, la muestra ecuatoriana de jugadores no patológicos (estudio 1) parece mostrar una mayor incidencia de un perfil impulsivo con comorbilidades externalizantes (particularmente con el abuso del alcohol, ver Tabla 1.2), lo que también viene sugerido por el hecho de que la personas con niveles problemáticos de juego suelan buscar ayuda por trastorno por abuso de sustancias (estudio 3). Este hecho podría explicarse, en parte, por las características sociales y legales de Ecuador, donde el juego de azar es ilegal desde el 2011. Existe evidencia de que las actividades ilegales suelen atraer a perfiles más impulsivos y con mayor riesgo de incurrir en actividades ilícitas (White, Tice, Loeber y Stouthamer-Loeber, 2002).

“Recordar sólo lo que me ocurrió hace siete meses en Roulettenburg, antes de mis pérdidas definitivas en el juego… lo perdí todo entonces, todo... salí del casino, me registré los bolsillos, y en el del chaleco me quedaba todavía un gulden: «¡Ah, al menos me queda con qué comer!», pensé, pero cien pasos más adelante cambié de parecer y volví al casino…. ¡Mañana, mañana acabará todo!”

“El jugador” Novela que refleja el problema con el juego de azar del que sufría Fyodor Dostoyevsky, 1867

CAPÍTULO 1

Introducción general y antecedentes del trastorno por juego de azar.

Justificación, objetivos, hipótesis y normas éticas.

1.1. Definición e incidencia del trastorno por juego de azar

El trastorno por juego de azar (TJA) se caracteriza por la participación problemática, persistente y recurrente en juegos de azar con apuestas económicas, y la incapacidad para eliminar o reducir dicho comportamiento a pesar de la gravedad de sus consecuencias negativas. Según el Manual Diagnóstico y Estadístico de Desórdenes Mentales, 5ta Edición (*Diagnostic and Statistical Manual of Mental Disorders*, DSM-V; APA, 2013), el diagnóstico de TJA requiere la presencia de al menos 4 de los siguientes criterios en un periodo de 12 meses: (1) necesidad de apostar cantidades de dinero cada vez más altas para lograr la emoción deseada; (2) irritación cuando se intenta reducir o parar el juego; (3) intentos fallidos para controlar, reducir o parar el juego; (4) preocupación por los juegos de azar (por ejemplo, pensamientos persistentes de revivir experiencias de juego anteriores, compensar ventajas entre competidores, planificar la próxima "aventura", o pensar en formas de obtener dinero con las que apostar); (5) uso del juego para calmar estados emocionales negativos; (6) tendencia a regresar a jugar para intentar recuperar dinero perdido en sesiones o días anteriores; (7) ocultación o engaño sobre el grado de participación en el juego; (8) pérdida o puesta en riesgo de relaciones interpersonales significativas, trabajo u oportunidades educativas o profesionales a causa del juego; (9) dependencia económica de otros que proporcionan dinero para aliviar situaciones financieras desesperadas causadas por el juego. El grado de severidad del TJA es considerado como medio si se cumplen 4 o 5 criterios, moderado 6 o 7 criterios, y severo 8 o 9 criterios.

Más allá del enfoque individual, el TJA debe ser abordado por organizaciones de salud tanto nacionales como internacionales, que actúen de manera eficaz ofreciendo intervenciones tempranas y tratamientos adecuados (Abbott, 2017a). En concordancia con esta postura, en 1980 el juego de azar patológico (denominación anterior) fue formalmente reconocido por la Asociación Americana de Psiquiatría (*American Psychiatric Association*, APA), y fue incluida por primera vez en el DSM-III (APA, 1980) en la categoría de *trastornos por control de impulsos*.

Desde entonces, el estudio neurocognitivo y comportamental del TJA se ha incrementado progresivamente. Actualmente, por un lado, existe un acuerdo amplio en que las características neurobiológicas y comportamentales del TJA son similares a las del trastorno por uso de sustancias (Hodgins, Stea y Grant, 2011; Leeman y Potenza, 2012; Mann, Fauth-Bühler, Higuchi, Potenza y Saunders, 2016; Petry, 2010; Romanczuk-Seiferth, Koehler, Dreesen, Wüstenberg y Heinz, 2015). Entre las características que comparten ambos trastornos están (1) las altas tasas de comorbilidad, (2) aspectos relacionados con el procesamiento de recompensa y castigo, (3) similitudes neurofisiológicas (relativas a la implicación del estriado ventral y los circuitos vinculados), y (4)

la implicación de rasgos de impulsividad y compulsividad (Fauth- Bühler, Mann y Potenza, 2017). Esto ha permitido que el TJA sea incluido en el DSM-V (APA, 2013) en una nueva categoría de trastornos adictivos no relacionados con sustancias, y es probable que esta nueva clasificación se mantenga en ediciones futuras. Sin embargo, por otra parte, recientemente también se han descrito diferencias entre los trastornos por consumo de sustancias y por juego de azar. Concretamente, con imagen cerebral por PET (Tomografía por emisión de positrones), se han encontrado diferencias relevantes en la implicación de la liberación de dopamina durante la anticipación y procesamiento de la recompensa (Clark y cols., 2018).

La prevalencia del TJA en población adulta actualmente oscila entre el 0.1% y 6% (Calado y Griffiths, 2016), dependiendo de la población de estudio y de los instrumentos diagnósticos utilizados. Sin embargo, es probable que estos porcentajes tiendan a incrementarse con los procesos de globalización, que han generado nuevas modalidades de juegos de azar y nuevas formas de acceso al mismo (como, por ejemplo, a través de Internet o por teléfono móvil). Además, las compañías que operan estas nuevas modalidades ofrecen a sus clientes nuevos métodos de pago que, probablemente, también contribuyen a su potencial adictivo (Abbott, 2017b).

Desafortunadamente, la mayoría de los estudios de prevalencia disponibles han sido llevados a cabo en países con buenas condiciones socioeconómicas e industriales, y mucho menos en países en vías de desarrollo, incluidos los países de América Latina (Gowing y cols., 2015). En Ecuador, específicamente, los estudios de este tipo no existen, en parte debido a la prohibición de la mayoría de los juegos de azar. Esta peculiaridad limita el acceso a la información relacionada con los posibles jugadores con problemas, así como a la disponibilidad de psicoeducación, asesoramiento y tratamiento para los jugadores en riesgo o con TJA. A pesar de ello, y más allá de las cuestiones de legalidad, el juego de azar en Ecuador no es infrecuente; las peleas de gallos, los bingos de beneficencia, la lotería, el rasca-y-gana, y los juegos de apuestas por Internet, son las modalidades más comunes. En España, por el contrario, el juego es una actividad legal y ampliamente extendida, su publicidad está escasamente regulada, tiene grados de exposición infantil y adulta muy altos, y una prevalencia del problema por juego de azar en las poblaciones adolescente y adulta que oscila entre el 0.4 y el 7.6% (incluyendo modalidades de juego presenciales y por Internet) (Jiménez-Murcia, Fernández-Aranda, Granero y Menchón, 2014).

1.2. Definición y tipos de regulación emocional

La regulación emocional es un ingrediente importante de la salud mental, y su alteración está relacionada con un amplio espectro de psicopatologías. Sin embargo, en el trastorno por juego de azar su estudio ha sido escaso, y recientemente algunas investigaciones han revelado a los problemas de regulación emocional como un fuerte indicador de psicopatologización y mantenimiento del TJA (ver Navas y cols., 2019; Orlowski, Bischof, Besser, Bischof y Rumpf, 2019). De allí que el estudio del papel de la regulación emocional en el TJA constituye el tema central de este trabajo.

Las emociones, tanto negativas como positivas, tienen la capacidad de modular el comportamiento y la cognición, y permiten su adaptación a las demandas ambientales, facilitando la supervivencia (Scherer, 1982). Sin embargo, las emociones pueden estar también en la base de comportamientos desadaptativos, de tal manera que, gracias a la acción de la evolución biológica y cultural, hemos desarrollado herramientas que nos permiten regularlas (Aldao, Nolen-Hoeksema y Schweizer, 2010). La regulación emocional se define como un conjunto de procesos cognitivos por los cuales las personas modifican la experiencia y la expresión de las emociones, lo que les permite responder de forma efectiva a las exigencias del ámbito social y personal (Aldao y cols., 2010). Esta acción puede ejercerse por la activación de mecanismos de control cognitivo dirigidos por metas (de manera consciente) o, de forma automática, como respuesta a estímulos asociados con experiencias previas, que influyen sobre la emoción ya sea incrementándola, o reduciéndola (Gross y Jazaieri, 2014; Gross, 2015).

Los mecanismos de regulación emocional pueden operar en cualquier punto del proceso que va desde la generación misma de la emoción hasta su expresión conductual (Ochsner y Gross, 2005). Estos mecanismos, además, difieren entre ellos en el grado de implicación de los procesos estratégicos de control cognitivo. Desde el campo del aprendizaje por reforzamiento se han desarrollado modelos computacionales del comportamiento de elección (Doya, Samejima, Katagiri y Kawato, 2002) que distinguen entre dos tipos de control: **m*odel-free*** (libre de modelo) y ***model-based*** (basado en modelos)**.** En el primer tipo, el control del comportamiento no requiere de la representación explícita de sus consecuencias más o menos remotas, sino que se produce de forma automática (y guiada por mecanismos asociativos que se fortalecen progresivamente sobre la base de señales de error predictivo). En el segundo caso, el control se caracteriza por la aplicación de reglas explícitas y conocimiento previo, y requiere de la representación de las consecuencias que pudieran tener las distintas alternativas de decisión.

Etkin, Büchel y Gross (2015) utilizan esta distinción para ofrecer un marco conceptual unificado de la regulación emocional. De este modo, la regulación emocional *model-free* dependería de procesos asociativos de aprendizaje (p.ej., extinción) y operaría de manera automática, con escaso control intencional por parte del individuo. Esto quiere decir que este tipo de regulación opera antes de que el individuo tome conciencia plena de la emoción que está siendo regulada. La expresión diferencial de ciertas emociones en función del contexto, por ejemplo, ocurriría de esta manera. Sin embargo, cuando el individuo regula sus emociones en modo *model-based,* adquiere conciencia de la emoción y modifica algún aspecto del estímulo que la provoca o de sus consecuencias para alterar el signo o la intensidad de esta. En este marco, las estrategias de afrontamiento (p.ej., jugar para calmar el estrés) y las estrategias cognitivas (p.ej., reinterpretación) serían ejemplos de regulación *model-based*, mientras que la mayor o menor sensibilidad a los cambios de contingencia que ocurren en tareas asociativas serían ejemplos de regulación *model-free* (Navas y cols., 2019).

1.3. Instrumentos de medida de la regulación emocional y su relación con indicadores de salud mental

1.3.1. Cuestionarios de regulación emocional

La mayor parte de los instrumentos actualmente disponibles para evaluar la regulación emocional están diseñados para cuantificar el uso de estrategias de regulación emocional, que entrarían dentro de la definición de regulación *model-based* descrita en el apartado anterior. El más extendido de estos instrumentos es el Cuestionario de Regulación Emocional (*ERQ; Emotion Regulation Questionnaire*), basado en la teoría de Gross y sus colaboradores (p.ej. Gross y John, 2003), que evalúa dos tipos de estrategias de regulación emocional: la *reevaluación* y la *supresión emocional*. La reevaluación es el mecanismo de regulación de estados internos, que permite realizar cambios o reconstruir significados asociados con eventos o situaciones estresantes, con el fin de disminuir el impacto emocional negativo (Gross, 1999). Esta estrategia de regulación emocional suele ser considerada como adaptativa y se la ha visto asociada con emociones positivas y menores síntomas depresivos. Por el contrario, la supresión emocional consiste en reducir las expresiones externas (conductuales) de las experiencias emocionales, y, cuando se usa de forma crónica o sistemática, se torna una estrategia desadaptativa o menos saludable, debido a su ineficacia para reducir la experiencia interna negativa a largo plazo (John y Gross, 2004; Williams, Grisham, Erskine, Cassedy, 2012).

Por su parte, el Inventario de Supresión del Oso Blanco (*The White Bear Suppression Inventory*), es una medida que se enfoca principalmente en identificar a las personas que presentan intentos fallidos de supresión de pensamientos no deseados (a diferencia del ERQ que evalúa la supresión emocional o expresiva), y que se relaciona con medidas de vulnerabilidad emocional y síntomas de psicopatología (Rassin, 2003). A pesar de su validez factorial, se trata de un cuestionario más limitado, ya que no está basado en un modelo que permita la evaluación de diferentes estrategias de regulación emocional, y que se encuentran involucradas en el bienestar psicológico.

El Cuestionario de Regulación Emocional Cognitiva (*CERQ; Cognitive Emotion Regulation Questionnaire*) evalúa el uso de nueve estrategias diferentes para la regulación de las emociones causadas por eventos negativos o aversivos: (1) *auto-culparse,* se refiere a los pensamientos de hacerse responsable de lo que ha causado la emoción experimentada; (2) *culpar a otros,* se refiere a los pensamientos de responsabilizar a otras personas por lo que ocurre; (3) la *rumiación,* consiste en la focalización obsesiva en sentimientos o pensamientos asociados a los eventos negativos; (4) la *catastrofización,* se refiere a enfatizar y sobrestimar las experiencias negativas o sus consecuencias; (5) *poner en perspectiva,* consiste en pensamientos que descartan la gravedad del evento o lo relativizan en comparación con otros eventos; (6) la *refocalización positiva,* se refiere a redirigir la atención en temas alegres y agradables; (7) la *reevaluación positiva,* se refiere a la reinterpretación del evento en términos positivos de crecimiento personal; (8) la *aceptación,* incluye la resignación sin juzgar; y (9) la *refocalización en la planificación,* se refiere a pensar en los pasos que se deben tomar para manejar la situación resultante del evento. Este cuestionario tiene una buena validez factorial y una alta fiabilidad, con un α de Cronbach que oscila entre 0.75 y 0.87 (Garnefski, Kraaij y Spinhoven, 2001). Este cuestionario, al igual que el ERQ, evalúa la *reevaluación,* pero subdividiéndola en diferentes tipos (poner en perspectiva, refocalización positiva, reevaluación positiva), y por tanto aporta una información más específica de estrategias de regulación emocional adaptativas y no adaptativas.

Todos estos instrumentos han sido utilizados como índices o predictores de salud mental (Gross y Jazaieri, 2014), lo que ha permitido llegar a la conclusión de que la desregulación emocional está involucrada en el desarrollo de diversas patologías (Hofmann, Sawyer, Fang y Asnaani, 2012). Específicamente, en los trastornos del estado de ánimo, los síntomas de depresión y ansiedad suelen estar asociados con estrategias de regulación emocional consideradas desadaptativas, tales como la supresión (del pensamiento o expresiva), o la rumiación, y suelen estar ausentes las estrategias de regulación emocional consideradas como adaptativas (por

ejemplo, la reevaluación, la refocalización en la planificación y la aceptación; Schäfer, Naumann, Holmes, Tuschen-Caffier y Samson, 2017). Asimismo, se ha constatado que, al comparar participantes con síntomas de depresión, no deprimidos y vulnerables a la depresión (participantes con historial de síntomas depresivos), los individuos deprimidos y los vulnerables a la depresión, obtienen puntajes significativamente más altos en supresión del pensamiento que los individuos no deprimidos (Rude y McCarthy, 2003). También se hipotetiza que el incremento de los síntomas y el mantenimiento del trastorno de ansiedad se debe a la dificultad para controlar o regular las emociones (Cisler y Olatunji, 2012). En relación a esta última afirmación, Sheppes, Suri y Gross (2015) consideran que dichas dificultades para regular las emociones suelen estar asociadas con la incapacidad para identificar la necesidad de regular las emociones y la incapacidad para seleccionar e implementar estrategias reguladoras de la emoción.

En el ámbito de las adicciones y, más concretamente, en el juego de azar, sin embargo, el panorama podría ser bastante distinto. De acuerdo con la hipótesis planteada por Navas y colaboradores (2019), al menos una parte de los jugadores problemáticos utilizarían estrategias de regulación emocional habitualmente consideradas adaptativas, como la reevaluación, para reinterpretar los eventos negativos relacionados con el juego de azar (p.ej., las pérdidas), incrementar la sensación de habilidad, y así justificar y mantener el deseo de continuar jugando. De esta manera, las distorsiones cognitivas que habitualmente mantienen los jugadores representarían una forma de razonamiento motivado (Kunda, 1990). Los jugadores problemáticos harían un uso específico de estrategias de regulación emocional *model-based* para mantener las distorsiones cognitivas relacionadas con el juego de azar (p.ej., el jugador intentaría reducir el impacto de las consecuencias negativas derivadas del juego de azar justificando sus pérdidas, reevaluando la situación para atribuirlas a causas transitorias, o disfrazándolas como progresiones de sus habilidades con el juego). Existe, de hecho, evidencia de que las puntuaciones en los cuestionarios destinados a evaluar el uso de las estrategias de regulación emocional habitualmente consideradas adaptativas y que promueven el bienestar psicológico tienen una relación paradójica con las distorsiones cognitivas propias del juego de azar (Navas, Verdejo-García, López-Gómez, Maldonado y Perales, 2016). Esta forma de uso contraproducente de estrategias de regulación emocional que en otros ámbitos se han mostrado como adaptativas sería especialmente relevante en el TJA, pero se ha observado también en otros trastornos adictivos (Martínez-González y cols., 2016).

1.3.2. Impulsividad emocional y regulación emocional incidental (*model-free*)

En términos generales la impulsividad se refiere al déficit de los procesos cognitivos y comportamentales relacionado con el control, la planificación y la premeditación, que generalmente resultan en una reacción precipitada y, en muchas ocasiones, inadecuada para la situación externa o interna que la desencadena, o insensible a las consecuencias que resultan de ese comportamiento (Brewer y Potenza 2008; Fineberg y cols., 2014).

La idea de impulsividad emocional se origina en los modelos multidimensionales de impulsividad que distinguen, a grandes rasgos, entre ésta y la impulsividad cognitiva (Knezevic-Budisin, Pedden, White, Miller y Hoaken, 2015). Uno de estos modelos es el modelo UPPS-P, que se desarrolló a partir de otros instrumentos previos de medida de la personalidad impulsiva (Evenden, 1999; McCrae y Costa, 1999; Whiteside y Lynam 2001) y que plantea la existencia de 5 dimensiones: (1) *falta de premeditación (FPrem)*, la tendencia a tomar decisiones sin considerar las consecuencias; (2) *falta de perseverancia (FPers)*, la incapacidad para permanecer concentrado en tareas exigentes; (3) *búsqueda de sensaciones (BS)*, la predisposición a realizar actividades nuevas y excitantes; y (4) *urgencia negativa (UN)*; y (5) *urgencia positiva (UP)*, que representan, respectivamente, las tendencias a perder el control bajo emociones negativas y positivas (Lynam, Smith, Whiteside y Cyders, 2006). De estas 5 dimensiones las dos primeras hacen referencia a la impulsividad cognitiva, mientras que las tres siguientes están asociadas a la impulsividad emocional. Esta última categoría se ha visto fuertemente vinculada con el trastorno por consumo de sustancias y con el TJA (Albein-Urios, Martínez-González, Lozano, Clark y Verdejo-García, 2012; MacLaren, Fugelsang, Harrigan y Dixon, 2011; Vitaro, Ferland, Jacques y Ladouceur, 1998). De hecho, algunos autores han mostrado evidencia de que los individuos con TJA y los consumidores de sustancias en comparación con sujetos controles sanos, tienen la disposición a participar en acciones precipitadas y temerarias, especialmente cuando experimentan una emoción positiva o negativa (Cyders y Smith, 2008). A este respecto, algunos estudios reportan que la impulsividad emocional, en comparación con otros tipos de impulsividad, es particularmente relevante para comprender ciertas psicopatologías, y a su vez podría ser un objetivo importante en su tratamiento (Johnson, Tharp, Peckham, Carver y Haase, 2017). En un estudio de Johnson, Carver y Joormann (2013) se encontró que la impulsividad emocional está relacionada con síntomas de psicopatologías externalizantes en general (p.ej., trastorno límite de personalidad, agresividad). Y en una revisión se concluyó que existe relación entre la desregulación emocional y las conductas de riesgo y dañinas (conductas sexuales de riesgo, consumo de sustancias; Weiss, Sullivan y Tull, 2015).

De forma más concreta, sobre la relación entre psicopatologías externalizantes y la impulsividad emocional, los estudios realizados con adolescentes en situaciones de riesgo han reportado una fuerte asociación entre la urgencia negativa y el comportamiento delictivo, las actividades ilícitas y los comportamientos antisociales (Ibrahim, Ismail, Halim y Amit, 2015; Mackey y cols., 2017; Mann y cols., 2017). Estos resultados convergen con los de los estudios que han explorado el historial de comportamientos delictivos en jugadores de azar (Martins, Tavares, da Silva Lobo, Galetti y Gentil, 2004; Mestre-Bach y cols, 2018; Mishra, Lalumière, Morgan y Williams, 2011), y con los que constatan que la UN se asocia a una mayor comorbilidad del TJA con psicopatologías externalizantes (Grall-Bronnec y cols., 2012; Savvidou y cols., 2017). Del mismo modo, en estudios sobre el comportamiento alimentario se ha observado que las puntuaciones elevadas en UN están relacionadas con la desregulación emocional generalizada, siendo ambas, además, predictores del trastorno alimentario (Pivarunas y Conner, 2015).

Estos hallazgos muestran que los comportamientos impulsivos realizados bajo estados emocionales tienen un impacto particularmente negativo sobre todo un abanico de comportamientos que dependen de una correcta regulación emocional, y que este tipo de impulsividad es la manifestación observable de una alteración bastante generalizada de procesos de regulación emocional que, muy probablemente, quedan fuera del control estratégico del individuo (Cheetham, Allen, Yücel y Lubman, 2010; Navas y cols., 2019). Con relación a ello, en este trabajo hipotetizamos que la impulsividad emocional, fundamentalmente la urgencia negativa, es la principal manifestación conductual de los problemas de regulación emocional *model-free*. El primer motivo para defender esta hipótesis es teórico. Las personas con alta urgencia negativa reportan sentirse invadidas por estados emocionales incontrolables antes de manifestar un comportamiento impulsivo, lo que es compatible con la idea de que estas personas presentan problemas en las primeras fases de generación y appraisal de la emoción. Y el segundo motivo es psicométrico: las personas con urgencia negativa alta tienden a presentar problemas para controlar comportamientos en las que está bien establecido que la regulación emocional juega un papel fundamental, tanto en contextos de la vida real como en el laboratorio (Navas y cols., 2017a).

Esto pone en evidencia la importancia de evaluar la regulación emocional incidental o *model-free*. Sin embargo, a diferencia de lo que ocurre con las estrategias de regulación emocional *model-based*, no existen instrumentos de medida diseñados específicamente para la medida de la regulación emocional *model-free*. Esto, en parte, se debe al hecho de que, por definición, los individuos tendrían poca capacidad para autoinformar del uso de mecanismos que son automáticos y, probablemente, parcialmente inconscientes. Por ello, y por las razones expuestas anteriormente,

en este trabajo, planteamos que la desregulación emocional *model-free* se evalúe mediante instrumentos que son sensibles a la intrusión de emociones en el pensamiento y la conducta cotidiana, en forma de *impulsividad emocional*.

1.4. De la regulación emocional al trastorno por juego de azar: el modelo de espacio de juego

Sobre la base de la evidencia revisada en las secciones anteriores, Navas y cols., (2019) han formulado recientemente el *Modelo de Espacio de Juego* (*GSM*, por el acrónimo en inglés de *Gambling Space Model*). Este modelo pretende dar cuenta de las diferencias individuales entre los jugadores de azar por medio de la integración de cuatro constructos (representados de forma simplificada en la Figura 1.1), todos ellos relacionados de una u otra forma con procesos de regulación emocional. Estos cuatro constructos dibujan un espacio multidimensional en el que el jugador ocupa una posición (en función del mayor o menor peso de esa dimensión en su comportamiento de juego). Esa posición puede cambiar a lo largo del tiempo, en función de la fase de la patología o del tratamiento en el que se encuentre y, lo que es más importante, tiene valor clínico y pronóstico, permitiendo la personalización del tratamiento.

Las cuatro dimensiones hipotetizadas son (1) la sensibilidad a las propiedades apetitivas del juego, (2) la sensibilidad a los componentes de reforzamiento negativo del juego, (3) la desregulación emocional generalizada y (4) la elaboración cognitiva motivada y de autoengaño. De todas estas dimensiones las dos últimas se encuentran relacionadas con la alteración de los mecanismos de la regulación emocional *model-free* y *model-based* que se han descrito en los apartados anteriores.

El primer constructo del GSM, la sensibilidad a las propiedades apetitivas del juego, está relacionada con la sensibilidad a distintas fuentes de reforzamiento. A este respecto, las ganancias en el juego y otras posibles fuentes de recompensa no necesariamente monetarias (p.ej., sensación de control y habilidad, excitación asociada a la incertidumbre) funcionan como reforzadores instrumentales, y al mismo tiempo contribuyen al condicionamiento Pavloviano de las claves presentes en el contexto de juego. Estos factores facilitan que el jugador desarrolle patrones habituales de juego y lo utilice, además, como un mecanismo para mejorar el afecto positivo (Rolls, 2004; van Holst, van den Brink, Veltman y Goudriaan, 2010). De acuerdo con un estudio de Navas y cols., (2017b) los jugadores con preferencias por los juegos de casino y habilidad

puntúan considerablemente más alto en variables relacionadas con este constructo que los de bingo, lotería o máquinas tragaperras.

Por el contrario, el segundo constructo, hace referencia a la sensibilidad al castigo. Puntuarían más alto en variables relacionadas con este constructo aquellos jugadores que utilizan el juego como un medio de escape de emociones negativas, funcionando éste por tanto como una estrategia de regulación afectiva para el jugador. Estos jugadores se corresponderían con el clúster de jugadores emocionalmente vulnerables propuesto por el *Pathways Model* (Blaszczynski y Nower, 2002), esto es, aquellos que tienden a presentar mayores tasas de comorbilidad con trastornos del estado de ánimo, y entre los que hay una mayor representación de mujeres que en otros clústeres.

En relación a la tercera dimensión, tal y como se ha descrito en un apartado anterior, se plantea la hipótesis de que la alteración de los mecanismos de regulación emocional *model-free* son reflejadas en el aumento de la urgencia negativa en una parte de los jugadores de azar. Por ejemplo, en un estudio reciente de Navas y cols., (2017a) se observó en un grupo de pacientes con TJA un alto grado de correlación entre la UN y el uso de supresión (estrategia de regulación emocional, evaluada con el ERQ). Por otro lado, también, se observó durante la realización de una tarea de regulación emocional en el laboratorio, una mayor activación (en los pacientes respecto de un grupo de controles) de las zonas cerebrales relacionadas con el esfuerzo mental y el control cognitivo (córtex prefrontal dorsolateral). Estos resultados sugieren, por una parte, que la UN puede ser un marcador de patologización en el juego de azar, a la vista de su asociación con otros indicadores de psicopatología más allá del juego. Y, por otra, que la base de dicha alteración es emocional, de tal manera que el mal funcionamiento de mecanismos básicos de regulación emocional, obligarían a algunos pacientes a recurrir a estrategias poco adaptativas y de alto coste cognitivo (p.ej., supresión) durante las tareas de regulación (a diferencia de los controles sanos que realizan las tareas de forma menos controlada pero más exitosa).

La cuarta dimensión de este modelo hace referencia al uso de los mecanismos de regulación emocional *model-based* para mantener las distorsiones cognitivas implicadas con el juego de azar. Tal como se planteaba en un apartado anterior, la utilización de algunas estrategias de regulación emocional consideradas adaptativas (y que generalmente contribuyen al bienestar psicológico, como la reevaluación) pueden ser utilizadas por algunos jugadores de azar con TJA para justificar o reducir el impacto de las pérdidas, mantener sus creencias erróneas sobre sus habilidades o su capacidad para controlar o predecir los resultados en el juego de azar. Dicho de otro modo, esta dimensión reflejaría la tendencia de los jugadores a utilizar estrategias cognitivas

complejas para proteger su ego, y se asociaría a la propensión a mantener creencias distorsionadas (sesgos cognitivos) sobre el juego.

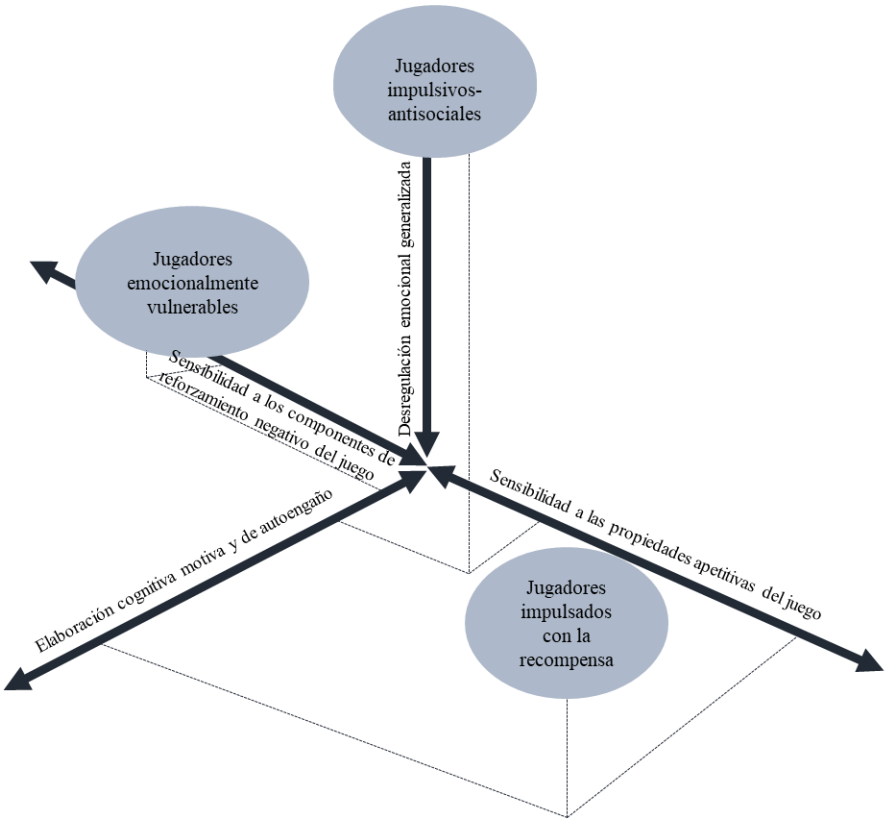

Figura 1. 1. *Dimensiones y subtipos de jugadores de azar según el Gambling Space Model (adaptado de Navas y cols., 2019)*

1.5. Brechas actuales en el estudio de la relación entre regulación emocional y juego de azar

1.5.1. Estudios transculturales

La naturaleza intrínsecamente adictiva del juego de azar podría explicar por qué esta actividad ha estado presente en todas las épocas de la historia y todas las culturas, y por qué se ha adaptado de forma tan flexible a través de lugares y grupos sociales diversos. Por otra parte, la globalización y las nuevas tecnologías han generado cambios importantes en las características, los modos de acceso y el impacto del juego en prácticamente todo el mundo (Calado, Alexandre y Griffiths, 2017). Sin embargo, es probable que la influencia de esas variables sea distinta en función de las condiciones preexistentes en distintos contextos culturales, legales y sociales. A pesar de ello, aún existen muy pocos estudios donde se tome en consideración la variable cultural o social y su

relación con variables psicológicas. Los modelos existentes sobre el TJA, fuertemente inspirados en el modelo biomédico de la psicopatología, se han desarrollado casi específicamente en muestras de países occidentales, educados, industrializados, ricos y democráticos (*WEIRD*, por sus siglas en inglés; Henrich, Heine y Norenzayan, 2010). Ello impide, a fecha de hoy, establecer con seguridad que las relaciones entre constructos, y entre ellos y el comportamiento de juego, que postulan estos modelos sean generalizables, o si pudieran ser más específicos de ciertos contextos culturales o sociales.

Comprobar la generalidad o no de las teorías sobre el juego de azar problemático, se vuelve aún más relevante al momento de tomar una decisión sobre el tipo de tratamiento más idóneo para tratar el TJA. Ésta es una razón por la cual algunos autores reconocen la importancia de realizar estudios transculturales, recomendando que se tomen en consideración los factores sociales y culturales en futuros estudios, además de los factores biológicos y psicológicos (Luo y Ferguson, 2017; Raylu y Oei, 2004a).

A pesar de la poca atención que hasta el momento han recibido los estudios transculturales, en la literatura se pueden encontrar investigaciones en las que se incluye la interacción de variables sociodemográficas con las especificidades contextuales. Así, por ejemplo, en culturas donde el juego de azar es socialmente aceptado y promovido a través de la publicidad, se ha podido observar que el inicio de las personas en el juego de azar suele ocurrir a edades más tempranas, en comparación con los países donde el juego de azar es ilegal o socialmente menos tolerado, donde la edad de inicio es más tardía (Luo y Ferguson, 2017). En relación a las diferencias de género, varios estudios realizados en diferentes culturas coinciden en que la incidencia de juego problemático es sistemáticamente mayor en hombres y también en ellos ocurre a edades más tempranas (Ellenbogen, Gupta y Derevensky, 2007; Gray, 2004; Shaffer, Hall y Vander Bilt, 1999). Esta sobre-representación de los varones y los adultos jóvenes dentro de los grupos de jugadores potencialmente problemáticos, de hecho, se esgrime como una prueba de que al menos algunos aspectos de la etiología del TJA sí dependerían de mecanismos neurocognitivos comunes a través de culturas (Gray, 2004).

Por otro lado, también se han reportado diferencias específicas significativas en variables psicológicas relacionadas con el comportamiento de juego entre diversos grupos étnicos. Por ejemplo, Medeiros y cols., (2015) describen que el perfil psicológico de los jugadores de azar brasileños difiere de el de los jugadores de azar estadounidenses. Los jugadores brasileños, en este estudio, se caracterizan por: (1) mostrar menos urgencia por ir a apostar inmediatamente después de haber jugado, (2) presentar mayor comorbilidad de depresión, y (3) un menor historial de

conductas de riesgo. Los jugadores de azar estadounidenses, por su parte, muestran: (1) más urgencia por ir a apostar inmediatamente después de haber jugado, (2) presentan mayor comorbilidad relacionada con el consumo de alcohol, y (3) el historial de conductas de riesgo es más común. Oei, Lin y Raylu (2008), muestran que existen diferencias significativas en relación a las distorsiones cognitivas y ciertos estados psicológicos entre grupos de jugadores de azar chinos y caucásicos. Más específicamente, los jugadores chinos presentaban puntuaciones más altas que los caucásicos en ansiedad y distorsiones cognitivas (GRCS: incapacidad para parar de jugar e ilusión de control). Sin embargo, en este mismo estudio al comparar los grupos étnicos por género, los resultados revelaban que las mujeres jugadoras de azar caucásicas presentan puntuaciones más altas de estrés que las mujeres jugadoras de azar chinas.

A pesar del esfuerzo de estos estudios por mostrar si existe diferencia o no entre los jugadores, de acuerdo a su situación social o cultural, aún existe la necesidad de comprobar y validar transculturalmente las teorías hasta ahora propuestas, más allá de los limitados aspectos explorados hasta la fecha. Más concretamente, y en relación directa a los objetivos de esta tesis, resultaría interesante comprobar si las relaciones entre regulación emocional y conducta de juego en las que se fundamenta el GSM se mantienen en contextos culturales distintos.

1.5.2. Regulación emocional y pronóstico del tratamiento psicológico

El tipo de intervención psicológica más utilizado para tratar el TJA es la terapia cognitivo-conductual, y generalmente se centra en 5 componentes: (1) información al paciente sobre el funcionamiento de los juegos de azar y las diferencias entre jugadores sociales y patológicos (psicoeducación), (2) intervenciones cognitivas donde se abordan las creencias irracionales que pudiera tener el paciente sobre el juego de azar, (3) entrenamiento para la resolución de problemas, (4) prevención de recaídas, y (5) entrenamiento en habilidades sociales (Cowlishaw y cols., 2012; Ladouceur, Boisvert y Dumont, 1994). La terapia cognitivo-conductual convive con otros paradigmas de tratamiento, así como con orientaciones no basadas en la evidencia, como las inspiradas en los modelos de *Alcohólicos Anónimos* o *Narcóticos Anónimos* (Petry, 2003a; Sussman, 2010).

La terapia cognitivo-conductual es también la terapia de elección recomendada en la mayoría de las guías clínicas (Nathan y Gorman, 2015). Sus distintas variantes han demostrado tener eficacia en la reducción de los sesgos cognitivos, la disminución en la frecuencia de juego, o el cese del juego a corto y a largo plazo (Hofmann, Asnaani, Vonk, Sawyer y Fang, 2012; Ladouceur, 2005; Pallesen y cols., 2005). Sin embargo, diferentes estudios han informado que la

eficacia de dicho tratamiento, medida a través de las tasas de abstinencia, oscila entre el 50% y 75% después de los 6 meses de haber recibido el tratamiento, 50% al año, y 30% a los dos años de seguimiento (Jiménez-Murcia y cols., 2010), y la tasa de abandono prematuro está alrededor del 30% (Aragay y cols., 2015; Melville, Casey y Kavanagh, 2007). A pesar de estas cifras, los estudios relacionados con variables que pueden ser potencialmente predictoras del abandono o del cumplimiento terapéutico han sido poco exploradas. En una revisión sistemática, Melville, Casey y Kavanagh (2007) mencionaban que, hasta aquella fecha, la evidencia sobre las variables específicas que predicen el abandono terapéutico, eran limitadas e inconsistentes, atribuyendo esta deficiencia a problemas metodológicos y a la falta de un modelo más específico y coherente para el juego de azar. En esta misma revisión se menciona que entre las variables predictoras más significativas de abandono se encuentran variables sociodemográficas (mayor edad, no estar empleado a tiempo completo, soporte social), variables relacionadas con el juego de azar (edad temprana en el inicio del juego, mayor cantidad invertido en el tiempo del juego, menos deuda en el juego), y comorbilidades con otros problemas psicológicos (ansiedad, desórdenes por consumo de alcohol y drogas, altos puntajes de impulsividad). Más recientemente, un estudio de Maniaci y cols., (2017) han reportado que las comorbilidades psiquiátricas, como el trastorno de personalidad negativista, el trastorno de personalidad antisocial y la dependencia de drogas son predictoras de abandono prematuro del tratamiento. Por otro lado, en un estudio de Milton, Crino, Hunt y Prosser, (2002) se ha podido identificar que las comorbilidades relacionadas con el uso indebido de alcohol y drogas, y una mayor duración de los problemas causados por el juego de azar, predicen el incumplimiento del tratamiento. Y más recientemente, en un estudio realizado por Mallorquí-Bagué y cols., (2018) se halló que las puntuaciones altas en urgencia negativa (UPPS-P) también son predictoras del incumplimiento terapéutico. Sin embargo, los estudios para identificar variables predictoras de cumplimiento o adherencia terapéutica son escasos.

En concordancia con estos hallazgos parciales entre variables de diferencias individuales y pronóstico del juego, muchos autores concuerdan en que los pacientes deberían recibir un tratamiento psicológico de acuerdo con sus características individuales y socioculturales (Bonnaire, Bungener y Varescon, 2009; Petry, 2003b; Ramos-Grille y cols., 2015; Richard, Baghurst, Faragher y Stotts, 2017; Suomi, Dowling y Jackson, 2014). En relación a ello, en el *Gambling Space Model* (Navas y cols., 2019) se plantean diferentes implicaciones clínicas de acuerdo al perfil neuropsicológico y comportamental de los jugadores de azar (representados en la Figura 1.1), y a su vez hacen predicciones concretas sobre el pronóstico terapéutico. Por ejemplo, el primer grupo *sensibilidad a las propiedades apetitivas del juego*, está caracterizado

por jugadores de azar que suelen tener poca motivación para dejar de jugar debido a que las recompensas obtenidas en el juego de azar (ya sean monetarias y/o emocionales) son su mayor motivación, y suelen ser pacientes con un pronóstico de abandono terapéutico. El segundo grupo *sensibilidad a los componentes de reforzamiento negativo del juego,* suelen ser jugadores emocionalmente vulnerables, presentan comorbilidades internalizantes (ansiedad, depresión), y suelen tener un mayor riesgo de recaída. El tercer grupo *desregulación emocional generaliza,* son jugadores que tienen una baja conciencia del problema, presentan comorbilidades externalizantes (comportamientos impulsivos, antisociales) y suelen presentar un mayor riesgo de abandono terapéutico. Y en el cuarto grupo *elaboración cognitiva motiva y de autoengaño,* se ubican a jugadores con distorsiones cognitivas, suelen tener mayor preferencia por los juegos de habilidades (p.ej., póker, ruleta), tienen menos motivación para el cambio, y suelen renunciar al tratamiento.

A pesar de estos esfuerzos, hasta la fecha, en el tema de la rehabilitación de los pacientes con TJA aún no quedan claras algunas cuestiones, entre ellas, por ejemplo, no se conocen resultados de tratamientos en los que se haya implementado una terapia en base a uno de los modelos teóricos mencionados anteriormente. En parte, esto es debido a que muchas de estas teorías o divisiones de los jugadores carecen de comprobación empírica y metodológica (Milosevic y Ledgerwood, 2010). Por otro lado, tampoco se sabe de tratamientos en los que se haya considerado a los predictores de abandono o recaída hasta ahora propuestos por otras investigaciones. Actualmente, se conocen variables que predicen un pronóstico negativo del tratamiento (abandono, recaída, incumplimiento), pero no se han examinado variables psicológicas, en especial las que se encuentran fuertemente vinculadas con el TJA (impulsividad emociona, regulación emocional), que aporten con un buen pronóstico terapéutico (cumplimiento o adherencia al tratamiento).

1.5.3. Función ejecutiva y toma de decisiones

Un buen número de estudios han intentado esclarecer si el trastorno por juego de azar se asocia a déficits específicos en tareas de función ejecutiva, con una gran parte de tales estudios centrados en las funciones de inhibición y flexibilidad (Ellis, Carr y Ledgerwood, 2018; Ledgerwood y cols., 2012; Rochat, Maurage, Heeren y Billieux, 2018;).

La inhibición se define como la capacidad cognitiva que tiene el sujeto para detener un comportamiento repetitivo o continuo, y suele ser evaluada con tareas *GO/NO-GO* (Kertzman y cols., 2017). Su papel en el juego se deriva de su posible implicación en el control de impulsos,

ya que los jugadores de azar problemáticos tienden a exhibir un patrón de toma de decisiones en el que ignoran, repetidamente, las consecuencias negativas derivadas del juego de azar, a cambio de obtener una gratificación monetaria y emocional inmediata. La flexibilidad, por su parte, tiene dos componentes: (1) la flexibilidad cognitiva, hace referencia a la facilidad que tiene el sujeto para cambiar rápidamente de una tarea (o un set mental) a otro, y (2) la flexibilidad en el aprendizaje se refiere a la capacidad del individuo para adaptar las decisiones a los cambios ambientales acompañados de contingencias de reforzamiento. La relación de la flexibilidad con el juego vendría dada por la similitud que existe entre la incapacidad para abandonar una respuesta previamente reforzada (perseveración/compulsividad) y la incapacidad de los jugadores para controlar la conducta de juego a pesar de la acumulación de pérdidas y otros resultados negativos (van Timmeren, Daams, van Holst y Goudriaan, 2017).

Aunque los resultados no son concluyentes, y está bastante claro que las alteraciones ejecutivas sólo afectarían a una parte de los pacientes con TJA (Fernández-Serrano, Pérez-García, Perales y Verdejo-García, 2010; Perales y cols., 2019), la evidencia parece indicar que las alteraciones de la flexibilidad (y más específicamente de la flexibilidad en el aprendizaje) pueden tener una mayor relevancia y/o incidencia entre pacientes con TJA que otras alteraciones relacionadas (Torres y cols., 2013a; Torres y cols., 2013b). Este aspecto de las funciones ejecutivas se ha medido, fundamentalmente, con tareas de toma de decisiones bajo ambigüedad, esto es, con tareas en las cuales el participante debe elegir entre dos o más opciones de decisión cuyas consecuencias son inicialmente desconocidas, pero sobre las que se debe ir aprendiendo en función de las recompensas y castigos recibidos ensayo a ensayo. Crucialmente, las contingencias de recompensa y castigo son probabilísticas (de forma similar a como ocurre en la mayor parte de los casos en la vida cotidiana) y, además, dichas contingencias pueden ser dinámicas, de modo que la estrategia de decisión óptima puede cambiar a lo largo de la tarea. El más conocido de tales protocolos es la *Iowa Gambling Task* (IGT, Bechara, Damasio, Damasio y Anderson, 1994), una tarea en la que los participantes deben aprender a decidir, de entre cuatro mazos de cartas, cuáles son ventajosos y cuáles desventajosos en el largo plazo. La dificultad de la tarea reside en que los mazos desventajosos ofrecen recompensas de forma más frecuente y penalizaciones de forma más infrecuente, y los ventajosos presentan el patrón contrario, de tal manera que los participantes deben aprender por ensayo y error a ignorar los mazos que, aparentemente, ofrecen más recompensas. Algunos estudios han concluido que esta tarea es sensible al daño en la corteza ventromedial, aunque todavía se discute qué mecanismos (Contreras, Catena, Cándido, Perales y Maldonado, 2008).

Por otro lado, en la tarea probabilística de aprendizaje de inversión (*Probabilistic Reversal Learning Task*, PRLT; Swainson y cols., 2000), el participante debe elegir entre dos estímulos (dos parches de color en la pantalla); una de las opciones es recompensada con mayor probabilidad que la otra, de tal manera que el participante desarrolla preferencia por ella. Sin embargo, sin previo aviso, las contingencias se invierten, de tal manera que la opción más ventajosa pasa a serlo menos y viceversa. El participante debe detectar esta inversión y desarrollar una nueva preferencia. Este cambio puede ocurrir varias veces a lo largo de la tarea, y una pobre ejecución se manifiesta en una conducta *perseverativa*, esto es, la continuidad en la elección de una opción que previamente ha sido ventajosa cuando ya ha dejado de serlo (esto es, tras la inversión).

A pesar de que la PRLT se postuló para aislar los procesos que parecían estar involucrados en la IGT y que explicaban su relación con el vmPFC (Swainson y cols., 2000), lo cierto es que sigue siendo compleja y parece depender de varios componentes cognitivos. Por una parte, se ha utilizado como una medida de compulsividad generalizada, esto es, como una medida de la tendencia de las personas a generar hábitos inflexibles de comportamiento tras una fase de entrenamiento con una determinada contingencia de reforzamiento, en la que el individuo adicto muestra dificultades para cambiar un patrón de respuesta a pesar de la exposición repetida de la retroalimentación negativa, sin embargo, en un estudio de Fernández-Serrano y cols., (2012) atribuyen estos patrones de respuesta, no como indicativos de perseveración, sino más bien a indicativos de alteraciones más globales en el *aprendizaje flexible de estímulo-refuerzo* que afecta transversalmente el aprendizaje inicial como la reversión. Por otra parte, la PRLT tiene un importante componente afectivo, y, recientemente, se ha propuesto que pudiera utilizarse como un índice de la integridad de los procesos de regulación emocional automática (Braunstein, Gross y Ochsner, 2017). Estos procesos son los responsables de que, de forma incidental, los estímulos o las varias opciones en un menú de decisión, adquieran un valor afectivo determinado, y ese valor se actualice adecuadamente cuando las circunstancias contextuales cambian. En este caso la regulación emocional implica una reevaluación cognitiva que en cierto modo permite tomar decisiones basadas en el razonamiento más que intuitivas o impulsivas. Estos procesos pueden ser evaluados con pruebas psicométricas y, más concretamente, con medidas de impulsividad de base emocional (p.ej.: urgencia negativa, Anestis y Joiner, 2011; Weiss, Tull, Anestis y Gratz, 2013).

Sin embargo, hasta el momento, por un lado, no se ha explorado la ejecución de la PRLT y su relación específica con procesos controlados frente a procesos automáticos, es decir, la ejecución de la PRLT como un indicador de los mecanismos de regulación emocional *model-free*, así como el papel de la urgencia negativa en la misma. Y, por otro lado, debido a la complejidad

de la PRLT por los diferentes componentes cognitivos que puede evaluar, los investigadores no han podido ponerse de acuerdo sobre los mejores índices para analizar el rendimiento de la tarea.

1.6. Hipótesis y objetivos

Entre los factores más estudiados con relación al curso del TJA están la impulsividad y la desregulación emocional. Por ejemplo, en el modelo teórico que proponen Blaszczynski y Nower (2002), la impulsividad es uno de los factores que contribuyen al desarrollo del juego problemático y se considera especialmente relevante en el subgrupo de *jugadores impulsivos-antisociales* (descrito en la introducción en la introducción). Muchos estudios han avalado la relación entre impulsividad y juego problemático (ver p.ej., Secades-Villa, Martínez-Loredo, Grande-Gosende y Fernández-Hermida, 2016; Vitaro, Brendgen, Ladouceur y Tremblay, 2001). Al mismo tiempo, han permitido avanzar en la comprensión de la impulsividad como un constructo multifactorial, y han resaltado la importancia de la impulsividad de base afectiva como el origen de dicha relación. Un segundo grupo, con alto nivel de patología en ese modelo, estaría constituido por los *jugadores emocionalmente vulnerables*, que estaría compuesto, principalmente, por jugadores problemáticos que utilizan el juego de azar como estrategia para afrontar estados afectivos negativos. La impulsividad, la regulación emocional y los procesos en los que ambos constructos se solapan se consideran por tanto factores cruciales para entender el TJA y las variaciones individuales entre jugadores, patológicos o no. Recientemente, esa idea ha sido retomado por el ***Gambling Space Model*** (GSM; Navas y cols., 2019), que supone la base teórica de la presente tesis.

El objetivo fundamental de este trabajo es avanzar en la comprensión del papel de la impulsividad y de la regulación emocional (y los procesos en los que ambas se solapan; la impulsividad de base emocional) en el juego de azar y los problemas derivados del mismo. Pretendemos conseguir ese avance en tres direcciones:

1) La corroboración de las relaciones ya conocidas entre los constructos de interés y las manifestaciones conductuales y clínicas del juego en población ecuatoriana. Puesto que el GSM es un modelo inspirado psicobiológicamente, se espera una réplica fiel de dichas relaciones, en concordancia con las ya reportadas en estudios anteriores.

2) Corroboración del valor pronóstico de los constructos de interés. Más concretamente, se pretende identificar qué variables de las propuestas podrían afectar a la probabilidad de abandono terapéutico temprano y al cumplimiento de las indicaciones terapéuticas en pacientes con TJA, en este caso en una muestra española. A este respecto, la hipótesis general es que estas

variables probablemente afecten de forma directa a la motivación para dejar de jugar (p.ej., aspectos reforzantes del juego) y/o a la relación del jugador con su entorno social.

3) La exploración de tareas de laboratorio que puedan ser sensibles a los mecanismos neurocognitivos que sustentan la impulsividad y la regulación emocional. En el presente caso, se escogió la tarea Probabilística de Aprendizaje de Inversión Afectivo (*Affective Probabilistic Reversal Learning Task*, PRLT). Dicha tarea ha sido propuesta como un indicador de la capacidad de los individuos de adaptar de forma flexible las decisiones a las consecuencias afectivas de las mismas. Si eso es así, se esperaba, no sólo una ejecución alterada en pacientes con TJA, sino también una vinculación a algunas de las dimensiones de impulsividad/regulación afectiva antes mencionadas. Este estudio se lo realizó en una muestra de pacientes con trastorno de abuso de sustancias en tratamiento que, además, presentaban problemas de juego, y controles sanos ecuatorianos.

Estas hipótesis se encuadran en un marco teórico compuesto por varios modelos. Por una parte, el modelo UPPS-P de comportamiento impulsivo (Lynam, Smith, Whiteside y Cyders, 2006) y el modelo ERQ de regulación emocional (Gross y John, 2003) nos proporcionan las bases psicométricas para la medida de las principales variables predictoras de interés. El modelo neurocognitivo de regulación emocional de Etkin, Büchel y Gross (2015) proporciona la base para integrar esas variables en un modelo psicobiológicamente plausible y, por tanto, para establecer predicciones concretas acerca de la relación entre ellas y tareas de laboratorio como la PRLT. Por último, el GSM nos permite integrar los modelos anteriores en una visión de conjunto del TJA y las diferencias individuales entre jugadores, patológicos o no.

1.7. Normas éticas

El procedimiento de los tres estudios que se presentan en los siguientes capítulos cumplen con las normas de la Declaración de Helsinki de 1975, revisadas en el 2008, y fue aprobado por el Comité de Ética de estudios humanos de la Universidad de Granada (España), como parte del proyecto de investigación PSI2013-45055-P. Asimismo fue aprobado por el Comité de Ética de la Facultad de Psicología de la Universidad de Guayaquil. Todos los participantes fueron informados de los objetivos del estudio y firmaron un documento donde dieron su consentimiento para la participación voluntaria.

CAPÍTULO 2

Types of emotion regulation and their associations with gambling: A cross-sectional study with disordered and non-problem Ecuadorian gamblers

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Tipos de regulación emocional y sus asociaciones con el juego de azar: Un estudio transcultural con jugadores de azar ecuatorianos con y sin diagnóstico de Trastorno por juego de azar.

A version of this chapter has been submitted for review to a scientific journal

2.1. Introduction

This chapter is aimed at to corroborating the predictions of the Gambling Space Model (GSM), in relation to the involvement of model-free and model-based emotion regulation (in the form of *generalized emotion dysregulation* and *cognitive elaboration and self-deception*) in an Ecuadorian sample.

As described in the general introduction, *generalized emotion dysregulation* is regarded here as the failure to inhibit or control the intrusion of thoughts and expression of behaviors driven by strong emotions, and, particularly, negative ones (e.g. aggression). The GSM borrows the concept of *negative urgency* from the UPPS-P model of impulsivity (Lynam, Smith, Whiteside, & Cyders, 2006; Whiteside & Lynam, 2001), and uses it as a proxy to measure the behavioral manifestation of a failure to effectively regulate intense negative emotions. As described earlier, negative urgency has been reported to be one of the strongest indices of pathological status and complications among gamblers (Billieux et al., 2012). Converging studies have explored the neurobiological roots of negative urgency in basic emotion regulation processes (Chester et al., 2016; Ruiz de Lara, Navas, Soriano-Mas, Sescousse & Perales, 2018), and have shown that negative urgency plays a major role in an array of externalizing psychopathologies, including other addictions (Johnson, Carver, & Joorman, 2013; Johnson, Tharp, Peckham, Carver, & Haase, 2017).

Motivated *cognitive elaboration and self-deception* includes cognitive biases by mean of which the gambler attempts to reduce the impact of negative consequences derived from gambling, or to justify and maintain their desire and motives for gambling. The Gambling-Related Cognitions Scale (GRCS; Raylu & Oei, 2004b), for example, evaluates five gambling-related cognitive domains. *Inability to stop* (e.g. "I'm not strong enough to stop gambling") and *gambling expectations* (e.g. "Gambling makes things seem better"), refer to personal beliefs of lacking the ability or capacity to control gambling impulses, and overvaluing the joy, reward or relief that can be obtained from gambling, respectively. *Illusion of control* (e.g. "Praying helps me win"), *predictive control* (e.g. "When I have a win once, I will definitely win again"), and *interpretative biases* (e.g. "Relating my losses to bad luck and bad circumstances makes me continue gambling") are distortions of reality involving causal attribution processes, and are categorized together, in a narrower sense, as gambling-related cognitive biases.

Several models identify cognitive biases as a target of therapeutic approaches (Chrétien, Giroux, Goulet, Jacques, & Bouchard, 2017), and their biological bases are now subject to intense

scrutiny (Clark, 2017). The particularity of the GSM model regarding these cognitive distortions is formulating them as resulting from elaborated emotion regulation mechanisms, in line with the motivated reasoning hypothesis (Kunda, 1990). At difference with *model-free* emotion dysregulation, these mechanisms are strategic, and their effective use requires some preservation of high-order cognition.

The GSM provides a multidimensional space to characterize different gamblers' profiles in the risky disordered range, and makes several specific, and sometimes counterintuitive predictions. The first one states that gambling-related cognitive biases (namely, illusion of control, predictive control, and interpretative biases) are more tightly related to emotion and motivation-driven aspects of impulsivity than to its cognitive facets. This prediction arises from conceptualizing cognitive biases themselves as resulting from strategies to enhance or to deal with the same positive and negative emotions that trigger impulsive behaviors. This pattern of correlations was found in a large British sample (Michalczuk, Bowden-Jones, Verdejo-Garcia, & Clark, 2011), and closely replicated in a Spanish one (Del Prete et al., 2017).

The second prediction is more specific: if cognitive biases reflect a reinterpretation of gambling related events, or justifications of feelings and motives, they should be associated with the dispositional use of reappraisal-related strategies. However, reappraisal and related cognitive emotion regulation strategies have been customarily considered adaptive, wellbeing enhancing strategies (and thus related to better psychological health), in contrast with other less effective, costlier strategies (e.g. suppression), that have been related to poor psychological health (Gross & John, 2003; Potthoff et al., 2016). In line with this prediction, a recent study, by Navas et al. (2016) showed that a cluster of gambling disorder patients with stronger cognitive distortions were more prone to use the strategy *putting in perspective* (from the Cognitive Emotion Regulation Questionnaire, CERQ, Garnefski & Kraaij, 2006) in daily life. Additionally, not only higher scores in GRCS, but also *putting in perspective*, and *refocusing on planning* (both of which are customarily considered adaptive strategies) were positively related to gambling severity.

A third specific prediction arises from the GSM model and a related work by Navas et al., (2017a). As described above, negative urgency is considered a marker of malfunctioning of model-free emotion regulation mechanisms. Navas et al., (op. cit.) found that gambling disorder (GD) patients with higher negative urgency scores show more intense activation of control-related prefrontal areas during a lab-based negative emotion regulation task, revealing that such patients experienced more cognitive load and needed to invest more executive resources to solve the task

(see also Chester et al., 2016). In parallel, negative urgency correlated with more frequent use of emotion suppression (from the *Emotion Regulation Questionnaire*, ERQ, Gross & John, 2003). This was interpreted as evidence that malfunctioning of basic emotion regulation mechanism generates some degree of overload upwards, and thus interferes with the balanced use of strategic emotion regulation. Here, we intend to replicate such an association between negative urgency and dispositional use of suppression to regulate negative emotions.

The fourth and last prediction also regards the overlapping between negative urgency and basic emotion dysregulation. In accordance with the abovementioned proposal that negative urgency underlies, not only GD, but also other disordered externalizing behaviors, we expect negative urgency to emerge as a complication marker, including an elevated risk of comorbidity with misuse of alcohol and other drugs. To our knowledge, this prediction remains untested.

In summary, the GSM and previous evidence support the following associations regarding the role of emotion regulation in gambling: (1) Gambling-related cognitive biases are more tightly linked to affect and motivation driven impulsivity than to cognitive impulsivity dimensions. (2) Gambling-related cognitive biases show associations with the use of elaborate emotion regulation strategies customarily regarded as adaptive and wellbeing-promoting. (3) Negative urgency reflects malfunctioning of basic regulation mechanisms, which breaks the balance between these and strategic emotion-regulation mechanism, thus altering the normal use of such strategies (and increasing the use of emotion suppression). And (4) negative urgency is associated with an elevated risk of GD comorbidity with other externalizing behaviors, including misuse of alcohol and other drugs.

So far, these associations have been observed in gamblers from countries where gambling is a legal leisure activity. The aims of the present study were, first, to directly replicate them, and thus test the soundness of the GSM, and second, to test them in a context in which sociocultural specificities plausibly have a large impact on the features and composition of gamblers' population. The GSM is a psychobiology-informed model. Social factors are expected to interact with the proposed neurocognitive mechanisms (particularly positive and negative reinforcement mechanisms), and thus to exploit some or other vulnerability paths, and increasing or decreasing the frequency of certain gambler profiles but are not expected to change the basic set of relationships between constructs, or between those constructs and main clinical features.

2.2. Methods

2.2.1. Participants and procedure

Community regular gamblers and patients undergoing treatment for addictive disorders (mostly alcohol use disorder) and with problematic gambling at *Centro de Recuperación Nueva Luz*, and *Centro de Recuperación Integral de Alcoholismo y Drogadicción* (CRIAD), from Guayaquil, Ecuador, were contacted as potential participants. Non-patients were recruited by posting bills at the University of Guayaquil premises. All patients were receiving treatment for at least one addictive disorder, diagnosed by a clinical psychologist, based on DSM-IV criteria. All potential participants were also briefly interviewed to check for inclusion criteria, namely being between 18 and 65 years old, not having suffered a head injury or neurologic problem, and not having been ever diagnosed with any psychiatric or psychological disorder (apart from addictive disorders in the patient subgroup). Additionally, (a) patients were fully assessed only if they reported a previous history of significant problems as a consequence of gambling [as corroborated by a score larger than ≥ 4 in the South Oaks Gambling Screen questionnaire (SOGS, Spanish version; Echeburúa, Báez, Fernández-Montalvo, & Páez, 1994)], and (b) non-patients were fully assessed if they reported gambling at least twice a week. The final sample consisted of 27 patients from the rehabilitation centers and 170 community regular gamblers.

The assessment consisted of a two-hour session. Some of the instruments were not relevant for the present purposes and will be reported elsewhere. All the assessments were carried out by an Ecuadorian Clinical Psychologist with a master's degree in neuroscience. The assessment protocol was divided in four blocks (cognitive tests, computer tests, emotion and personality tests, and a clinical interview). Block order, and task order within each block were counterbalanced.

Sociodemographic data and main measures' scores for both subsamples are reported in the following table (Table 2.1).

Table 2.1. *Sociodemographic data and scores in target measures from community gamblers and patients*

	Community gamblers	**Patients**
Sociodemographic variables		
Sex	39% females	26% females
Age	34.36 (13.73)	25.74 (8.34)
Years of education	13.20 (4.02)	12.52 (2.33)
ERQ		
Reappraisal	30.41 (7.65)	29.81 (9.06)
Suppression	17.47 (6.58)	15.89 (7.08)
SOGS		
Severity	3.60 (3.55)	7.78 (4.54)
MC		
Alcohol	0.35 (0.35)	0.64 (0.33)
Drugs	0.08 (0.20)	0.77 (0.25)
UPPS-P		
Negative Urgency	2.49 (0.78)	2.73 (0.84)
Positive Urgency	2.51 (0.71)	2.79 (0.58)
Sensation Seeking	2.66 (0.89)	2.97 (0.76)
Lack of premeditation	1.75 (0.63)	1.89 (0.64)
Lack of perseverance	1.76 (0.62)	1.92 (0.63)
GRCS		
Gambling expectancies	3.83 (1.60)	3.56 (1.95)
Control illusion	2.36 (1.47)	3.09 (1.69)
Predictive control	3.17 (1.50)	3.90 (1.75)
Inability to stop	2.13 (1.34)	2.93 (1.68)
Interpretative bias	3.04 (1.80)	3.83 (2.08)

Note: ERQ: emotion regulation questionnaire; SOGS: South Oaks gambling screen; MC: MultiCAGE CAD-4; GRCS: gambling-related cognitive scale

2.2.2. Instruments

2.2.2.1. Gambling severity and other problematic behaviors

The *South Oaks gambling Screen* (SOGS¸ Lesieur & Blume, 1987) is customarily used to assess gambling severity, dependence, and debt accrual, and is the most common tool in international gambling research. Was originally based on DSM-III-R diagnostic criteria for pathological gambling but has been later shown to have good convergence with DSM-IV and DSM-V (Stinchfield et al., 2016). Only the total severity score will be used in the present study. The Spanish version used in this study has shown good psychometric properties (Echeburúa et al., 1994)

The *MultiCAGE CAD-4* (Pedrero Pérez et al., 2007) is a screening tool used to detect self-regulation problems in several behavioral domains (problem gambling, excessive spending/shopping, alcohol misuse, drug misuse, hypersexuality, excessive internet use, excessive video gaming, and dysregulated eating behavior). Each subscale consists of four yes/no items, checking for current cravings, others´ complaints about the potential problematic behaviors, guilt or shame feelings and/or lack of self-acknowledgment, and self-reported compensatory behaviors. Only the alcohol and illegal drug misuse subscales will be used here. Both have shown appropriate psychometric properties and predictive validity of alcohol and drug abuse.

2.2.2.2. Impulsivity

The Spanish version (Cándido, Orduña, Perales, Verdejo-García, & Billieux, 2012) of the *UPPS-P impulsive behavior scale* (Whiteside & Lynam, 2001) contains 20 items, and allows for a 5-dimension assessment of impulsivity: positive urgency (e.g. "I tend to lose control when I am in a great mood"), negative urgency (e.g. "When I am upset I often act without thinking"), (lack of) premeditation (e.g. "My thinking is usually careful and purposeful"), (lack of) perseverance (e.g. "Once I get going on something I hate to stop"), and sensation seeking (e.g. "I quite enjoy taking risks ").

2.2.2.3. Gambling cognitions

The *Gambling Related Cognitions Scale* (GRCS, Raylu & Oei, 2004b) assesses five gambling-related cognitive domains: gambling expectancies (GE), illusion of control (IC), predictive control (PC), inability to stop gambling (ISG), and interpretative bias (IB). Its Spanish version has been recently validated by Del Prete et al. (2017), showing Cronbach's α values of 0.741, 0.713, 0.836, 0.896, and 0.859 for the abovementioned dimensions, respectively. Patients in our sample were

instructed to answer the questionnaire with regard to the time when they used to gamble (prior to therapy onset), whereas recreational gamblers were asked to answer the questionnaire in relation to the present time.

2.2.2.4. Emotion regulation strategies

The Spanish version (ERQ, Cabello, Salguero, Fernández-Berrocal, & Gross, 2013) of the *Emotion Regulation Questionnaire* (Gross & John, 2003) was used to assess the dispositional use of two emotion regulation strategies: reappraisal and emotional suppression. This questionnaire has shown adequate validity and internal consistency (Cronbach's α =0.75, 0.71, respectively).

2.3. Statistical analyses and results

The database and R Code for main analysis, as well as the JASP file containing complementary analyses (as described in the Appendix, Supplemental materials) are available without restriction at http://osf.io/zy9k8

2.3.1. Correlations

Correlations regarding the questionnaires involved in our main hypothesis, along with correlations of all traits with SOGS gambling severity, are displayed in Table 2.2. Shaded areas include correlations that were predicted to be significant according to our hypotheses, namely (a) correlations of affect and motivation driven UPPS-P impulsivity dimensions with GRCS gambling cognitions (15-member family), (b) correlations between ERQ reappraisal and gambling cognitions (5-member family), (c) the single correlation between UPPS-P negative urgency and ERQ suppression, and (d) correlations between UPPSP negative urgency and MultiCAGE alcohol and drugs subscales (2-member family). Correlations yielding significant two-tailed *p*-values, after family-wise Bonferroni correction are marked with an asterisk in the Table. All these correlations were also submitted to a network analysis; however, given this analysis is mostly redundant with main analysis, it is reported in the supplementary materials S1.

Importantly, these correlations are also likely to be explained away, not only by differences in severity among gamblers, but also by sociodemographic confounders. In the subsequent set of analyses, we test whether target relationships survive after controlling for relevant covariates.

2.3.2. Impulsivity (UPPS-P) – gambling cognitions (GRCS)

This analysis was aimed at testing the relationship between impulsivity scores (as measured by the five dimensions of the UPPS-P questionnaire) and gambling-related cognitions (as measured by the GRCS questionnaire), with UPPS-P scores as input variable, and GRCS scores as output variable, while controlling for potential confounders. All quantitative variables were translated into a zero-centered scale before any further analyses.

Table 2.2. *Correlations between variables*

	GRCS					***ERQ***		***MC***		***SOGS***
	GE	CI	PC	ISG	IB	Reap	Sup	Alcohol	Drugs	Severity
UPPS-P										
Neg. U	0.10	0.21*	0.18	0.09	0.15	-0.05	0.16*	0.22*	0.12	0.23*
Pos. U	0.04	0.26*	0.23*	0.16	0.20	-0.06	0.00	0.15	0.05	0.12
SS	0.21*	0.24*	0.21*	0.23*	0.24*	-0.02	0.05	0.07	0.01	0.16
Lprem	-0.06	0.04	-0.05	0.03	0.01	-0.09	-0.05	0.15	0.05	0.20*
Lpers	-0.01	0.08	-0.04	0.02	0.02	-0.05	-0.04	0.22	0.12	0.23*
GRCS										
GE						0.30*	0.23			0.30*
CI						0.27*	0.23			0.37*
PC						0.23*	0.21			0.39*
ISG						0.22*	0.12			0.51*
IB						0.24*	0.18			0.47*
MC										
Alcohol										0.48*
Drugs										0.37*

Note: GRCS: gambling-related cognitive scale (GE: gambling expectancies; CI: control illusion; PC: predictive control; ISG: inability to stop gambling; IB: interpretative bias); ERQ: emotion regulation questionnaire (Reap.: reappraisal; Sup.: suppression); MC: MultiCAGE CAD-4; SOGS: South Oaks gambling screen; Neg.U: negative urgency; Pos.U: positive urgency; SS: sensation seeking, Lprem: Lack of premeditation; Lpers: Lack of perseverance.
* Correlations yielding significant two-tailed *p*-values, after family-wise Bonferroni correction.

A baseline linear mixed-effects (LME) model was built with participant as a random intercept, SOGS score and SOGS x GRCS subscale (ISG, IC, PC, GE, and IB) as fixed effects, and GRCS scores in the five subscales as dependent measures (the differences between GRCS subscales were previously eliminated by centering). Confounders (age, monthly income, education years, and gender) were simultaneously added upon the baseline model but kept only if they significantly improved model fit. In order to do so, the baseline + all confounders model was tested against the same model without each of the confounders (*backward test*). The Akaike Information Criterion (AIC), and a likelihood ratio test were simultaneously used to make a decision on model fit. The all-confounders model lost fit only when education years was removed ($\Delta AIC = 3.704$, $L.Ratio = 5.704$, $p = 0.017$), so education years was kept, and age and gender were removed. The same logic was followed with confounders x GRCS subscale interactions (i.e. differential effects of confounders across subscales), but none of them substantially contributed to model fit. In consequence, the baseline + confounders model was composed of participant as the only random effect, and SOGS, SOGS x GRCS subscale, and education years as fixed effects.

To test the effects of UPPS-P variables on GRCS measures, a similar, yet more stringent, hierarchical method was followed. The effect of each UPPS-P dimension effect was kept if (1) removing it from a model with all UPPS-P dimensions hampered model fit (*backward test*), and (2) adding it to the baseline + confounders model improved model fit (*forward test*). Positive urgency passed the forward ($\Delta AIC = 6.957$, $L.Ratio = 8.957$, $p < 0.028$), and the backward ($\Delta AIC = 1.936$, $L.Ratio = 3.936$, $p = 0.047$) tests, and so did sensation seeking ($\Delta AIC = 9.739$, $L.Ratio = 11.739$, $p < 0.001$; $\Delta AIC = 4.256$, $L.Ratio = 6.256$, $p < 0.012$, for the forward and the backward test, respectively). These results suggest that gamblers with higher scores in those two UPPS-P dimensions also showed higher general GRCS scores, independently of gambling severity and potential confounders.

UPPS-P x GRCS subscale interactive effects (that is, the potential differential effect of UPPS-P dimensions across GRCS domains) were tested following the same hierarchical rationale, against the model resulting from the previous step. Only the positive urgency x GRCS measure interaction passed both the forward and backward tests ($\Delta AIC = 7.708$, $L.Ratio = 15.707$, $p = 0.003$; $\Delta AIC = 7.035$, $L.Ratio = 15.035$, $p = 0.005$), indicating that the effect of positive urgency varied across GRCS domains.

In summary, the best-fitting model contained the effects of positive urgency, $R\beta^2 = 0.018$ [CI90% 0 – 0.072; non-significant after including the interaction, $t(192) = -0.409$, p = 0.683],

sensation seeking, $R\beta^2$ = 0.031 [CI90% 0.02 – 0.096], and the positive urgency x GRCS subscale interaction, $R\beta^2$ = 0.020 [CI90% 0.08 – 0.048]. The interactive effect was thus followed with GRCS subscale-by-subscale regression analyses, with UPPS-P dimensions as predictors, and SOGS severity and education as potential confounders. This set of analyses yielded significant effects of positive urgency on illusion of control [β = 0.188, $t(189) = 2.576$, $p = 0.011$], predictive control [β = 0.188, $t(189) = 2.385$, $p = 0.018$], and interpretative bias [β = 0.140, $t(189) = 2.037$, $p = 0.043$]. In other words, the positive urgency x GRCS subscale interaction seemed to originate in the fact that positive urgency was associated to cognitive biases, but not to gambling expectancies or perceived inability to stop gambling.

2.3.3. Emotion regulation (ERQ) – gambling cognitions (GRCS)

An identical rationale was followed to test the relationships between emotion regulation strategies (ERQ suppression and reappraisal) and GRCS gambling cognitions, starting with the same baseline + confounders model.

In this case, only the reappraisal score passed both the forward and the backward tests (ΔAIC = 14.208, *L.Ratio* = 16.208, $p < 0.001$, and ΔAIC = 9.717, *L.Ratio* = 11.717, $p < 0.001$, respectively), with reappraisal correlating globally and positively with the intensity of gambling cognitions. Neither the reappraisal x GRCS subscale term, nor the suppression x GRCS subscale term contributed to improving model fit, so the effect of reappraisal must be considered generalized across the five GRCS gambling cognitions, with a size $R\beta^2$ = 0.079 [CI90% 0.022 – 0.163].

2.3.4 Impulsivity (UPPS-P) – Emotion regulation (ERQ)

In this case, UPPS-P scores were used to predict ERQ dispositional use of suppression and reappraisal to control negative emotions in daily life. The analysis rationale was as described in previous sections. However, in all models fitted with *nlme*, residuals remained non-independent from fitted values. In order to surpass that problem, standardized suppression and reappraisal scores were separately discretized in 7 bins with approximately the same number of observations (using the *cut2* function in the *Hmisc* R package; Farrell, 2018), and treated as ordinal variables. Discretization in 7 bins was used to keep the scoring as informative as possible, while maintaining a sufficient number of observations per bin. Cumulative-link linear mixed-effects modeling (CLME), with a logit link function (as implemented in the *ordinal* package in R; Christensen, 2015) was used in place of LME. In all other senses, the model construction and selection criteria

remained as described above (please note that, although discretization improved the final model, it did not affect the basic pattern of results).

A baseline CLME model was built with participant as random intercept, SOGS score and SOGS x ERQ subscale (reappraisal, suppression) as fixed factors, and ERQ scores in two subscales as dependent measures. The baseline + all confounders model lost fit when age (ΔAIC = 4.730, *L.Ratio* = 6.730, p = 0.009) and education years (ΔAIC = 5.058, *L.Ratio* = 7.058, p = 0.008) were removed, so these two factors were kept. No UPPS-P x ERQ subscale interactive effect contributed to model fit. The definitive baseline + confounders model was composed of participant as a random intercept, and SOGS, SOGS x ERQ dimension, age and education years as fixed terms. Subsequent models were tested against this one.

No UPPS-P dimensions contributed to model fit. However, the negative urgency x ERQ subscale interaction passed both the forward and the backward tests (ΔAIC = 4.280, *L.Ratio* = 8.280, p = 0.016, and ΔAIC = 4.996, *L.Ratio* = 8.996, p = 0.011, respectively).

This effect was thus followed with ERQ subscale-by-subscale CLM analyses, with SOGS, SOGS x ERQ dimension, age and education years as confounders, and UPPS-P scores as main predictors. In accordance with the global analysis, these analyses yielded a significant effect of negative urgency, restricted to the ERQ suppression subscale [z = 2.132, p = 0.033], with higher negative urgency scores signaling a more frequent dispositional use of suppression to control negative emotions.

2.3.5. Impulsivity – Drug and alcohol risk of misuse

Finally, we assessed the relationship between UPPS-P scores and risk of alcohol and illegal drugs misuse, as measured by the drug and alcohol subscales of the MultiCAGE. These scores range from 0 to 4 and were fitted as ordinal scores with the *ordinal* package (logit link).

A baseline model was built with participant as random intercept, SOGS score, MultiCAGE subscale (alcohol, drugs), and the SOGS x MultiCAGE subscale interaction as fixed terms, and MultiCAGE scores in two subscales as dependent measures. Given that raw MultiCAGE scores are ordinal in their original form, standardization was not feasible, and the MultiCAGE subscale effect was thus included in the baseline model. The baseline + all confounders model lost fit when education years (ΔAIC = 4.214, *L.Ratio* = 6.214, p = 0.013), monthly income (ΔAIC = 4.835, *L.Ratio* = 6.835, p = 0.009), and sex (ΔAIC = 7.288, *L.Ratio* = 9.288, p = 0.002) were removed, so these three factors were kept. The age x MultiCAGE subdimension (ΔAIC = 6.561, *L.Ratio* =

10.561, $p = 0.005$), the education years x subdimension ($\Delta AIC = 2.747$, $L.Ratio = 4.747$, $p = 0.029$), and the monthly income x subdimension ($\Delta AIC = 2.955$, $L.Ratio = 4.955$, $p = 0.026$) interactions contributed to model fit, and were also kept. Subsequent models were tested against this baseline + confounders + interactions model.

No UPPS-P dimensions simultaneously passed the forward and backward tests. Still, negative urgency passed the forward test ($\Delta AIC = 3.349$, $L.Ratio = 5.349$, $p = 0.021$), and fell close to passing the backward test ($\Delta AIC = 1.540$, $L.Ratio = 3.535$, $p = 0.060$; $z = 1.852$ in the saturated model).

2.4. Discussion

This study was aimed at testing the set of associations regarding the role of emotional regulation in gamblers' individual differences predicted by the Gambling Space Model (GSM), in the particular sociocultural context of a country where gambling is mostly illegal (i.e. Ecuador). With that aim in mind, we explored the associations between gambling cognitions (as measured by the GRCS), impulsivity (UPPSP), emotion regulation strategies (ERQ), and comorbid alcohol and drug misuse (Multi-CAGE CAD4). For analyses, personality (impulsivity) scores were used as inputs to predict dispositional variables (ERQ and GRCS scores), and symptoms (MultiCAGE drugs and alcohol subscales). All hypotheses were based on previous works, although the analysis strategy has been improved and homogenized in terms of sample size and composition, covariate control, and decision threshold stringency.

Results can be summarized as follows: (1) after controlling for gambling severity and relevant sociodemographic covariates, sensation seeking was positively associated with gambling cognitions, whereas positive urgency was positively associated with cognitive biases, defined in a narrow sense (interpretative bias, illusion of control, and predictive control) but not with other gambling cognitions (inability to stop and gambling expectancies). On the contrary, negative urgency was far from predicting any gambling cognitions. (2) Among emotion regulation strategies, reappraisal, but not suppression, was associated with gambling cognitions. (3) Negative urgency was distinctively associated with suppression, but not with reappraisal. And (4), no impulsivity dimensions substantially predicted comorbid drug and alcohol abuse, although negative urgency fell just below the decision threshold. These links were confirmed by a network analysis, as shown in the appendix (Supplemental materials, S1).

Jointly considered, these results reinforce the importance of emotion regulation processes in the cognitive and behavioral manifestations of gambling (Williams et al., 2012). Beyond that overarching corroboration, the first set of specific relationships confirms the affective nature of cognitive biases predicted by the *cognitive elaboration and self-deception* construct in the GSM model, and also mostly replicates previous findings by Michalczuk et al. (2011) and Del Prete et al. (2017). However, these studies did not segregate the effect of impulsivity from gambling severity and sociodemographic factors. In line with that, unconditional correlations between negative urgency and gambling cognitions were explained away by covariate control in further analyses. This negative finding thus qualifies our initial prediction about the potential link between gambling cognitions and motivation/affect driven impulsivity (which did not include any reference to possible differential influences of positive and negative affect/motives).

As noted in the introduction, the hypothesis that affect/motivation driven impulsivity is associated with cognitive biases was founded on the assumption that problem gamblers distort reality in an attempt to reduce the impact of negative consequences derived from gambling, or to justify and maintain their desire and positive motives for gambling. In other words, we assumed that cognitive biases would be equally fueled by *enhancement* regulation and *coping* regulation. Our data support the former possibility but certainly not the latter.

Results are more consistent with predictions regarding the linkage between emotion regulation strategies and cognitive biases. Extending Navas et al.'s (2016) findings, reappraisal was positively associated with gambling cognitions. This association not only corroborates the emotional roots of gambling cognitions, but also their overlap with high-order, model-based emotion regulation strategies**.** These strategies are customarily regarded as adaptive and have been linked to psychological adjustment and wellbeing (Aldao et al., 2010; Gross & John, 2003). Somewhat counterintuitively, these strategies seem to help gamblers deceive themselves, get an imaginary sense of mastery and justify their desire for gambling. Tentatively, enhancement of positive emotional states elicited by gambling episodes could bias the processing of gambling outcomes, altering associative and causal attribution learning, and thereby increasing the strength of gambling distorted beliefs (Navas et al, 2016).

The last two sets of hypothesized associations have implications beyond gambling symptomatology. The fact that negative urgency signals the dispositional use of suppression to regulate negative emotions (and, actually, seem to alter the balance between reappraisal and suppression) suggests that negative urgency is a marker of gambling 'over-pathologization', that is, a clue that psychopathology extends beyond gambling, to other potentially problematic behaviors. This possibility emerges from the extensive available evidence of a link between

suppression use and a variety of mental disorders (Wegner & Zanakos, 1994). However, our attempt to further corroborate this idea by finding an association between negative urgency and comorbid alcohol and drug misuse found only a suggestive and partial corroboration.

2.5. Limitations and strengths

These results must be interpreted in light of at least two limitations. First, effects are mostly subtle (mostly falling in the high end of the small size range [$R^2 = 0.01 – R^2 = 0.10$], or the low end of the medium size range [$R^2 = 0.1 – R^2 = 0.25$], according to customary conventions. This is partially attributable to the measurement error consubstantial to the scales used here, and also to the fact that some of them (e.g. *negative urgency*) were used as proxies to the key construct of interest (e.g. generalized emotion regulation failure). Further research is needed to find more direct ways to measure such constructs. Second, associations do not allow to establish causal directionality. Input and output variables in analyses were established on the basis of which of them were more basic traits (with personality traits considered more fundamental than dispositional or behavioral traits). Results reinforce the GSM because hypotheses emerged from it, but, definitely, other underlying structures are viable.

At the same time, this work also presents three remarkable strengths. First, its large sample size compared with studies of the same sort. Second, the sensitivity of statistical analyses, combined with a stringent criterion on model fit, designed to avoid false positives. And finally, its purely confirmatory nature, with all hypotheses emerging from previous works and GSM predictions.

2.6. Final remarks

Emotion regulation has a key role in many mental disorders. Very powerful models describing the different components of emotion regulation are also available in the recent literature. The proposal that different emotion regulation mechanisms differ in the degree of involvement of model-free vs. model-based processes (Etkin, Büchel & Gross, 2015) is particularly appealing, and seems to fit well with the different ways and levels of severity in which gambling disorder manifests in different patient profiles. Our results suggest different roles for the generalized emotion regulation failure (as measured by negative urgency), and the motivated use of reappraisal (customarily regarded as adaptive). The former seems to be characteristic of a complicated profile (probably overlapping with the impulsive-antisocial gambler subtype described by the pathways model, Blaszczynski & Nower, 2002), with heightened psychopathology and worse prognosis. The latter

seems however characteristic of overconfident, sophisticated gamblers, probably with well-preserved cognitive and intellectual abilities, but with complex networks of beliefs that help them maintain gambling motivation. We suspect this profile is associated with new gambling modalities, and more pervasive in young gamblers, and will probably be on the rise in the years to come (Gainsbury, Russell, Hing, Wood, Lubman, & Blaszczynski, 2015; Griffiths, Wardle, Orford, Sproston, & Erens, 2009).

Importantly, the context of the sample from which these data have been collected is very different to the British and Spanish samples of the studies from which hypotheses generated. In spite of the differences, results seem mostly analogue. Similarities are compatible with a cross-culturally valid and unique definition of gambling disorder, and also with the commonality of its basic neurocognitive mechanisms. The GSM is however sensitive to the interactions between those basic mechanisms and gambling exposure, which make us suspect that the same mechanisms could give rise to quite different proportions of the different gambler profiles across different cultural contexts, depending on factors like available gambling modalities, gambling exposure, spread of Internet access, or regulation of gambling advertising.

CAPÍTULO 3

Impulsivity and problem awareness predict therapy compliance and dropout from treatment for gambling disorder

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Impulsividad y conciencia del problema predicen la adherencia terapéutica y el abandono del tratamiento en el trastorno por juego de azar

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3.1. Introduction

Several studies have attempted to identify the contextual and individual factors that may predict the results of treatment of patients with gambling disorder. For example, Weinstock et al., (2011) concluded that sociodemographic factors, gambling severity, indebtedness and the level of coercion from legal and social networks predict the acceptance or rejection of treatment. Gambling patterns (Pickering, Keen, Entwistle y Blaszczynski, 2018), comorbidities (Maniaci et al., 2017), and the interpersonal support (Jiménez-Murcia et al., 2017) have also been suggested to be valuable indexes for the course of treatment and its results.

Even though in this thesis we have a special interest in the study of impulsive personality, specifically on emotionally based impulsivity, for being one of the most relevant variables in gambling disorder and other disorder related to alcohol and drug abuse. For this reason, in this chapter, a study centered in studying the impulsive personality in patients with gambling disorder is presented, and its potential value for predicting abandonment and adherence of therapeutic prescriptions during treatment. Our interest in advancing in the understanding of impulsivity is develop from other studies, that have converged in showing that: (1) impulsive people are more likely to present future gambling problems (Secades-Villa, Martínez-Loredo, Grande-Gosende, y Fernández-Hermida, 2016; van Holst, van den Brink, Veltman & Goudriaan, 2010; Vitaro, Brendgen, Ladouceur & Tremblay, 2001); (2) patients with GD with high levels of impulsivity are more likely to prematurely terminate treatment (Leblond, Ladouceur & Blaszczynski, 2003; Maccallum, Blaszczynski, Ladouceur & Nower, 2007); (3) impulsivity is linked to increased psychopathological comorbidity, including other addictions (Grall-Bronnec et al., 2012; Petry, 2010); and (4) impulsivity correlates with GD severity (Billieux et al., 2012).

Impulsivity is however better understood as a multidimensional construct (Cyders & Smith, 2007; Evenden, 1999). Recent factorial models distinguish between a *conscientiousness- planning* factor, reflecting the integrity of top down executive mechanisms, a *reward seeking* factor, characterized by the subjective overvaluing of reinforcement (despite possible negative consequences), and a *negative emotionality dysregulation* factor (Knezevic-Budisin, Pedden, White, Miller & Hoaken, 2015; Sharma, Markon & Clark, 2014).

Customary psychometric tools rely on factorial analyses of responses to self-report items to identify the components of impulsive behavior. In this regard, the UPPS-P model of impulsive behavior (Cyders et al., 2007; Whiteside, Lynam, Miller & Reynolds, 2001) has been shown to be advantageous over other impulsivity assessments, based on its discriminative capacity and

correspondence with dissociable psychobiological systems (Rochat, Billieux, Gagnon & Van der Linden, 2017). In spite of their undeniable theoretical value, alternative assessment methods, based on neuropsychological or decision-making tasks (see, for example, Torres et al., 2013a, 2013b), have yielded very modest associations with self-report tools even in very large samples (Cyders et al., 2011; MacKillop et al., 2016), and, to date, there is not a battery of tasks of this sort that can be considered as an overarching and time-efficient alternative to assess impulsivity as a multidimensional construct (Stahl et al., 2014).

As described earlier, according to the UPPS-P model, impulsivity is composed of (1) *positive* and (2) *negative urgency*, (3) *lack of premeditation*, (4) *lack of perseverance*, and (5) *sensation seeking*. Convergent validity analyses suggest that urgencies respond to a combination of emotional reactivity and executive dysregulation; lack of premeditation and perseverance mostly overlap with the conscientiousness/planning factor; and sensation seeking reveals a tendency for seeking reward in novel and exciting activities (Cyders & Smith, 2007; Sharma et al., 2014).

Among UPPS-P dimensions, negative urgency emerges as the clearest marker of severity in clinical levels (Billieux et al., 2012), although positive urgency and sensation seeking have also been observed to predict severity in treatment-seeking gamblers (Savvidou et al., 2017). Here, however, our interest is focused on the relationship between UPPS-P dimensions and treatment outcomes. To our knowledge, no previous studies have investigated the putative relationship between impulsivity, assessed in a multidimensional manner, and adherence/dropout during treatment.

Still, some related evidence allows us to make substantive predictions. On the one hand, at least two studies have focused on the possible link between constructs largely overlapping with sensation seeking and treatment dropout (Aragay et al., 2015; Jiménez-Murcia et al., 2012). These studies did not directly investigate impulsivity, but personality as assessed by the TCI questionnaire (*Temperament and Character Inventory*, Cloninger, Svrakic & Przybeck, 1993). Both of them reported one of these dimensions (*novelty seeking*) to predict dropout. Relatedly, a recent study (Mestre-Bach et al., 2016) has showed high scores in a trait also related to impulsivity and sensation seeking (reward sensitivity) to be associated with an increased probability of treatment dropout, but not disorder severity, occurrence of relapses, or treatment compliance. In view of this evidence, UPPS-P sensation seeking arises as a candidate to predict dropout.

On the other hand, given the connection of negative urgency with addictive behaviors via altered emotion regulation and dysfunctional coping skills (Adams, Kaiser, Lynam, Charnigo &

Milich, 2012), a significant contribution of negative urgency to poor adherence and treatment dropout seems highly plausible.

3.1.1. Aims and clinical implications

To date, most studies either have failed to consider other measures of adherence beyond permanence in treatment or have not explicitly distinguished between dropout and compliance (Melville et al., 2007). In Aragay et al. (2015), therapeutic compliance was not explicitly assessed. In Mestre-Bach et al. (2016), dropout was not considered when computing the number of relapses (making relapse and dropout somewhat confounded), and compliance was analyzed dichotomously (good vs. poor). To our knowledge, only Jiménez-Murcia et al. (2012) have assessed compliance (in 3-point good/fair/poor scale) separately from dropout. As noted earlier, in this study, an association was found between novelty seeking and dropout, but no significant predictors were identified for therapy compliance.

The aims of the present study are as follows: (1) to estimate the degree to which UPPS-P dimensions predict dropout from psychological treatment (in the six months following the initial assessment), taking into account several potential confounders; and (2) to test if these variables further predict the degree of compliance with therapeutic tasks and recommendations, specifically in those patients who remain in treatment.

Results potentially have direct clinical relevance. Changes in the gambling market associated with the emergence of new gambling modalities are posing a serious challenge for clinicians and rehabilitation services. As we have shown elsewhere (Navas et al., 2017b, 2019), new gamblers also present distinct psychological traits, and clarifying the prognostic value of such traits is a necessary step for tailoring treatment (Raylu & Oei, 2016).

3.2. Method

3.2.1. Participants

Sixty-six patients in treatment for GD [2 females, recruited from the Asociación Granadina de Jugadores de Azar en Rehabilitación (AGRAJER), a mutual help association based in Granada, Spain] participated in this study. As part of their admission protocol, all patients underwent a semi-structured interview based on DSM-IV for axis I and II disorders with their therapist, comprising all the necessary information to check for exclusion criteria. GD diagnosis was established by the therapist on the basis of such an interview and was confirmed by a score equal to or above 5 on

the South Oaks Gambling Screen (SOGS, Spanish version; Echeburúa, Báez, Fernández-Montalvo & Páez, 1994).

Inclusion criteria were: (1) a GD diagnosis; (2) having been in treatment for less than 6 complete months. Exclusion criteria were: (1) suffering any comorbid DSM-IV psychiatric disorder; and (2) any history of neurological disease or brain damage (as reported by the participant). Participants potentially suffering comorbid disorders or with a history of neurological damage were not invited to participate in the study. Signs of problematic alcohol or drug use were further assessed using the MultiCAGE CAD- 4 clinical screening questionnaire (Pedrero Pérez et al., 2007)

3.2.2. Procedure

Initial assessment. The initial assessment session lasted approximately three hours. It comprised several self-report questionnaires and neuropsychological tests, some of which are not directly relevant to the aims of this study, as were part of a larger protocol (G-Brain research project, PSI2013-45055-P), and have been described elsewhere (see, for example, Navas et al., 2017b; Navas, Verdejo-García, López-Gómez, Maldonado & Perales, 2016; Perales, Navas, Ruiz de Lara, Maldonado & Catena, 2017).

Importantly, given the characteristics of the treatment center, and the restricted availability of patients, it was not always possible to complete the initial assessment immediately after admission. In all cases, the initial assessment took place in the six first months of treatment. More specifically, this assessment took place in the first month of treatment for twenty-two patients, in the second month for twenty, in the third month for eight, in the fourth month for three, in the fifth month for seven, and in the sixth month for six (see average time in treatment in Table 3.1).

Follow-up. Six months after the initial assessment (and thus in all cases still within the first year of treatment), the patients' therapist was contacted again in order to collect information on the occurrence or non-occurrence of dropout and/or treatment compliance (see treatment compliance in the instruments section). Based on that information, the original sample was divided into two groups: 24 patients who dropped out from treatment (DO), and 42 patients who did not drop out from treatment (NDO). Descriptive statistics for the two groups are displayed in Table 3.1 (upper panel).

3.2.3. Instruments

3.2.3.1. Severity of gambling and other problematic behaviors

South Oaks Gambling Screen (SOGS, Lesieur & Blume, 1987; Spanish version, Echeburúa et al., 1994).

MultiCAGE CAD-4 (Pedrero Pérez et al., 2007). In the present study we used only the gambling, alcohol, and drug subscales, all of which have been reported to have good psychometric properties. The remaining subscales (excessive internet and videogame use, disordered eating, hypersexuality, and compulsive buying) are not relevant for the aims of the present study.

3.2.3.2. Estimated non-verbal intelligence

A non-verbal Intelligence Quotient (IQ) was estimated using the matrix reasoning task from the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler, 2008).

3.2.3.3. Impulsivity

The *UPPS-P* brief impulsivity scale (Spanish version, Cándido, Orduña, Perales, Verdejo-García & Billieux, 2012.

3.2.3.4. Dysphoric mood

Subclinical signs of poor mood were assessed by using the *Beck Depression Inventory–II* (BDI-II; Spanish version, Sanz, Perdigón & Vázquez, 2005). The BDI questionnaire was included in the protocol when some participants had been already assessed. That said, BDI data are missing for a total of 4 patients, all of whom were in the NDO group.

3.2.3.5. Treatment compliance

Treatment compliance in NDO patients was defined considering (1) attendance to therapeutic activities (e.g., group sessions); and (2) task completion and fulfillment of the therapist's guidelines for daily life functioning (e.g., keeping diaries up to date, not drinking alcohol). The therapist's records were used to assess all patients on a five-point scale, on which 5 meant full attendance and fulfillment, 4 meant attendance and fulfillment above 50%; 3 meant attendance above 50%, but a fulfillment of task and recommendations below 50%; 2 meant attendance and fulfillment of task and recommendations below 50%; and 1 attendance below 50% and nearly complete disregard of tasks and recommendations. Compliance level was assessed independently by two judges (second and fourth authors), with a concordance of $r = 0.952$. In the cases in which the judges' assessments did not match, the discordance was resolved by mutual agreement. Among

the 42 patients who did not drop out from treatment, 6 scored five points, 13 four points, 14 three points, 7 two points, and 2 one point.

3.2.3.6. Treatment characteristics

All participants followed the same treatment protocol, with the same therapist, and in the same facilities. This treatment is similar to the treatment implemented in other facilities belonging to the same Regional Federation as AGRAJER [*Federación Andaluza de Asociaciones de Jugadores de Azar en Rehabilitación (FAJER)*]. Treatment is mostly based on groups of mutual help –complemented with professional supervision and individual cognitive-behavioral therapy– and lasts for approximately two years. Features and stages of treatment are described in supplementary materials S2.

3.2.4. Statistical analyses

Dropout analyses. In order to describe differences between the NDO and DO groups, we first ran between group t-tests on sociodemographic and control variables. This analysis was carried out to identify possible confounders before analyzing between-group differences on impulsivity measures.

Secondly, we ran a multivariate analysis of variance/covariance (MANOVA-MANCOVA) on the five UPPS-P subscales. In case potential confounders were identified, these were intended to be included in the MANCOVA as covariates. A significant between-group multivariate effect was planned to be followed by variable-by-variable t-tests, in order to identify where the global multivariate effect originated. For all t-tests, p-values and Bayes factors are reported.

Third, variable-by-variable analyses were complemented with a stepwise logistic regression analysis, with group membership as the dependent variable (NDO vs DO) and impulsivity dimensions as predictors. This analysis was carried to test whether any of the impulsivity variables differing between the two groups predicted group membership independently of the others.

Compliance analyses in the NDO group. Fourth, for the NDO group only, we ran bivariate correlation analyses to estimate relationships between sociodemographic/control variables and the compliance measure. Again, these analyses were carried out to identify potential confounders to be considered in subsequent steps.

And lastly, impulsivity measures, along with potential confounders, were entered into a stepwise regression analysis of compliance. This was complemented with a Bayesian Regression analysis, to identify the most predictive combination of factors (including impulsivity measures and potential confounders), and the individual contribution of each of those factors therein.

Bayesian analyses and simple t-tests were carried out with JASP statistical software (http://jasp-stats.org). Bayesian analyses were performed with default software settings. MANOVA/MANCOVA and logistic regression analyses were run on SPSS 20.0 (IBM Corp, 2011).

As there were only 2 female participants in our sample, all analyses were run with and without them. Results were virtually identical in all cases, so we found no reason to exclude them. Reported results correspond to the whole sample.

3.3. Results

3.3.1. Group comparability checks

No significant differences were observed between DO and NDO groups in sociodemographic and control variables (Table 3.1, upper panel). Of particular importance is the corroboration that the two groups were well matched in duration of treatment at the moment of the initial assessment. Given that assessment was more delayed for some participants than for others, differential attrition prior to the first assessment could have unbalanced this variable in favor of one of the two groups. Matching thus ensures between-group comparability despite inter-individual differences in the moment of the initial assessment. Additionally, Bayes factors are consistently below 1 for all potential confounders, and below 1/3 in some cases, which indicates a good general matching between the two groups.

Due to slight changes in the form used to collect sociodemographic information during the study, age of gambling onset was available for only 49 participants. Of these, 17 were in the DO group and 32 in the NDO group. These two subgroups were far from substantially differing in onset age [mean (SD) 21.61 (7.69) and 19.47 (5.72), for NDO and DO subgroups, respectively, $t(47)=1.01$, $p=0.32$, BF10=0.45]. Complementarily, we had data on gambling modality preference (type I vs type II games, as defined in Navas et al., 2017b) for 65 participants. A Chi-squared test on the relationship between preferences and dropout was also non-significant [$\chi2(1)=1.475$, $p=0.225$].

Table 3.1. *Independent Sample t-tests and Bayesian t-tests on sociodemographic, control variables and impulsivity (UPPS-P) variables.*

	NDO	**DO**			
	***Mean* (*SD*)**	***Mean* (*SD*)**	**t**	***p***	**BF_{10}**
Sociodemographic and control variables					
Age	37.67 (11.33)	33.92 (10.46)	1.330	0.188	0.546
Years of education	12.86 (4.55)	12.42 (2.38)	0.440	0.661	0.283
Months in treatment	2.85 (1.72)	2.36 (1.34)	1.193	0.237	0.473
Matrix reasoning (WAIS-IV)	96.31 (14.86)	99.17 (14.42)	-0-759	0.450	0.332
BDI Dysphoric mood	9.92 (8.62)	12.13 (8.48)	-0.987	0.328	0.398
SOGS Severity	10.43 (3.26)	10.38 (3.54)	0.062	0.950	0.261
MC gambling	3.07 (0.89)	2.75 (0.94)	1.377	0.173	0.576
MC Alcohol	1.14 (1.37)	0.79 (1.22)	1.042	0.301	0.411
MC Drugs	0.52 (1.04)	0.42 (0.93)	0.418	0.678	0.280
UPPS-P					
Negative Urgency	2.73 (0.72)	3.10 (0.69)	-2.047	**0.045**	1.481
Positive Urgency	2.48 (0.59)	2.78 (0.53)	-2.061	**0.043**	1.516
Sensation Seeking	2.14 (0.66)	2.46 (0.91)	-1.647	0.104	0.808
Lack of Premeditation	2.19 (0.73)	2.28 (0.64)	-0.508	0.614	0.290
Lack of Perseverance	1.97 (0.68)	1.81 (0.64)	0.929	0.356	0.374

Note. Abbreviations: NDO = No dropout group; DO = dropout group; MC = MultiCAGE CAD-4. Significant tests are marked in bold.

3.3.2. Dropout

In view of the absence of potential confounders among the variables under consideration, no covariates were included in the subsequent multivariate analysis of impulsivity measures. The corresponding MANOVA yielded a main multivariate effect of group [Wilks' λ=0.823, p=0.035, $\eta 2_p$=0.177]. Variable-by-variable t-tests (Table 3.1, lower panel) yielded significant differences in positive and negative urgency between the two groups. The logistic regression model correctly classified 62.10% of participants (see Table 3.2), with positive urgency as the only predictor in the final model.

Table 3.2. *Results from the forward logistic regression analysis for group membership (no dropout [NDO] vs dropout [DO]).*

Dependent Variable	**Variables included**	**Variables excluded**	$-2\Delta L$	***Wald***	***p***	***N-R²***
NDO vs DO	*Positive Urgency*		4.285	3.882	**0.049**	0.086
		Negative Urgency				
		Sensation Seeking				
		Lack of premeditation				
		Lack of perseverance				

Note. *p* values for significant tests are indicated in bold. -2Δ*LL*: -: -2 log-likelihood change for positive urgency inclusion in the model; *N-R*2: Nagelkerke's R2.

It is important to take into account, however, that according to Bayes factors, t-tests on specific impulsivity dimensions portray only anecdotal evidence in favor of the alternative hypothesis. Significant p-values should thus be interpreted cautiously, as they are merely suggestive of the specific location of effects on general impulsivity, in the case that there are any.

3.3.3. Compliance

In the correlation analysis in the NDO group, compliance positively correlated with WAIS matrix reasoning score, the gambling subscale on the MultiCAGE CAD-4 questionnaire (MC-gambling), and BDI (Table 3.3). Gambling preferences (type I vs type II) did not significantly influence compliance [$t(63)=-0.63$, $p= 0.532$]. In other words, compliant patients had better reasoning abilities, presented a worse mood state, and regarded their gambling as more troublesome.

The stepwise linear regression analysis with these three factors and UPPS-P scores yielded significant effects for UPPS-P sensation seeking and MC-gambling score, with the former inversely predicting compliance and the latter positively predicting it (Table 3.4). As noted above, due to BDI data loss, there were 4 participants missing from this analysis. So, we re-ran it without BDI scores. Results from this analysis were qualitatively identical but notably neater [Adjusted $R2=0.308$, $p<0.001$; MC-gambling: $\beta=0.470$, $p<0.001$; Sensation seeking: $\beta = -0.330$, $p=0.015$].

Table 3.3. *Therapy compliance correlations with sociodemographic and control variables in the no-dropout group.*

	Therapy compliance	
	r	*p*
Age	0.053	0.737
Years of education	0.175	0.269
Gambling onset age	0.058	0.752
Months in treatment	0.190	0.228
Matrix reasoning (WAIS-IV)	0.392	**0.010**
Dysphoric mood (BDI)	0.366	**0.024**
Severity (SOGS)	-0.042	0.792
MC Gambling	0.482	**0.001**
MC Alcohol	-0.132	0.403
MC Drugs	-0.007	0.964

Note. p values for significant tests are indicated in bold. Abbreviations: MC = MultiCAGE CAD-4. For instruments details, see text. The correlation between gambling onset age and therapy compliance was performed on the 32 participants of the NDO group for whom these data were available.

These regression analyses were complemented with Bayesian regression modelling. As reported in Table 3.5, the model with the highest Bayes factor (31.73 relative to the null model), and thus best accounting for data, included UPPS-P negative urgency and sensation seeking, and MC-gambling. However, the three factors contributed differently to the model's predictive fit. The Bayes factor of the best model, relative to the equivalent ones without each of the three of factors, was 1.22, 4.65, and 49.57, when removing negative urgency, sensation seeking, and MC-gambling, respectively. In accordance with the standard regression analysis described above, whereas the models with and without negative urgency performed almost equally well (so negative urgency contributed very modestly to model predictive fit), the contributions of sensation seeking, and MC-gambling were substantial and strong (as indicated by Bayes factors above 3 and 10, respectively).

Table 3.4. *Results from the stepwise linear regression analysis for therapy compliance scores in the no dropout group.*

Variables included	Variables excluded	β	*t*	*p*	*Adj.* R^2
MC Gambling		0.465	3.311	**0.002**	0.272
Sensation Seeking		-0.319	-2.274	**0.029**	
	Matrix reasoning				
	Dysphoric mood				
	Negative Urgency				
	Positive Urgency				
	Lack of Premeditation				
	Lack of Perseverance				

Note. *p* values for significant tests are indicated in bold. MC: MultiCAGE CAD-4. See text for details of the measures.

Table 3. 5. *Results from the Bayesian linear regression analysis regarding therapy compliance in the no dropout group.*

Models	P(M)	P(M|data)	BF_M	BF_{10}
Null	0.004	$9.095 \cdot 10^{-4}$	0.232	1
MC Gambling + Negative Urgency + Sensation Seeking	0.004	0.029	7.576	31.725
MC Gambling + Sensation Seeking	0.004	0.024	6.172	25.982
MC Gambling	0.004	0.009	2.442	10.429
MC Gambling + Negative Urgency	0.004	0.006	1.591	6.817
Negative Urgency + Sensation Seeking	0.004	0.000582	0.148	0.64

Note. P(M): prior probability of the models. P(M|data): posterior probability of the models given data. BF_M: model Bayes factors. BF_{10}: model Bayes factors, relative to the null. The model performing best is marked in bold.

3.4. Discussion

Existing research has identified a number of individual variables that influence the risk of discontinuing therapy before completion (e.g., Ramos-Grille, Gomà-i-Freixanet, Aragay, Valero & Vallès, 2013), as well as some therapy features that increase or decrease clinical efficacy (e.g., Cowlishaw et al., 2012; Jiménez-Murcia et al., 2015). However, to our knowledge, none of these studies performed a detailed assessment of the different dimensions of impulsivity as predictors of dropout and therapy compliance, while controlling for potential confounders. Our results add upon the evidence that individual features determine patients' reaction to therapy (Billieux et al., 2012; Blaszczynski & Nower, 2002; Ledgerwood & Petry, 2006).

First, our results suggest that affect-driven dimensions of impulsivity discriminate between patients continuing and discontinuing therapy (DO and NDO). However, on the basis of theoretical relationships between negative urgency and key emotion regulation processes (see Billieux et al., 2012; Clark et al., 2012; Michalczuk, Bowden-Jones, Verdejo- Garcia & Clark, 2011), we had predicted this dimension to strongly and independently predict dropout. Although we found some evidence suggesting that negative urgency was higher in the DO group, that effect was explained away by positive urgency.

Aragay et al. (2015) and Jiménez-Murcia et al. (2012) had reported novelty seeking to predict dropout. The partially corresponding measure in the present study, sensation seeking, failed to discriminate between DO and NDO patients. However, sensation seeking and novelty seeking are not fully overlapping constructs (Cloninger, 1991; Cyders & Coskunpinar, 2011), and, most importantly, novelty seeking and positive urgency encompass similar appetitive motivational processes. This is consistent with the link between dropout and reward dependence we have observed in treatment for other addictions (López-Torrecillas, Perales, Nieto-Ruiz & Verdejo-García, 2014).

If confirmed, a potential predictive superiority of positive urgency relative to other reward-related dimensions of impulsivity could arise from the fact that urgency is more heavily weighted by control-related and executive processes (Billieux, Gay, Rochat & Van der Linden, 2010; Cyders & Smith, 2008; Dir, Karyadi & Cyders, 2013; Grall-Bronnec et al., 2012). Indeed, recent studies have identified two different pathways in which impulsivity might have an impact on potentially addictive behaviors. The first would involve the weakness of self-regulatory systems, and the second, an overreaction of automatic-affective systems (Lannoy, Billieux & Maurage, 2014). Our results suggest that these same two paths might also be involved in the risk of early

therapy dropout in GD. Both motivations to continue gambling (driven by the rewarding properties of gambling activities), and inability to regulate behavior under the influence of emotions generated by such appetitive motivators, might interfere with motivation to stay in treatment. Nonetheless, it is important to keep in mind that the difference between groups in positive urgency, although significant, portrayed little evidence of an actual effect. As noted earlier, any interpretation of this effect must be made cautiously.

With regard to therapeutic compliance in patients who did not abandon therapy during the follow-up period, results are more straightforward. Considered together, higher intelligence, depressive mood, more severe self-perceived gambling status, and lower sensation seeking scores positively correlated with compliance with the therapist's advice and instructions. In other words, not only do appetitive motives seem to increase the probability of discontinuing therapy, but also some degree of dysphoria seems to facilitate adherence in patients who do not abandon treatment.

Sensation seeking was the only impulsivity dimension predicting non-compliance, and, somewhat unexpectedly, higher scores on the MultiCAGE CAD-4 independently enhanced compliance. Tentatively, this relationship can be accounted for by awareness of the negative consequences of excessive gambling. In fact, the four MultiCAGE CAD-4 gambling-related items assess the presence of craving, feelings of guilt, recognition of having deceived others, and acknowledgement of family, financial or work problems. At least three of these items can contribute to a heightened perception of gambling disutility (and therapy utility), especially if we take into account that the MultiCAGE CAD-4-compliance link was found only in the less complicated cases of patients who had remained in therapy. This interpretation is compatible with previous reports that drug and alcohol users with higher scores in the CAGE questionnaire for alcohol abuse (the antecessor of Multi-CAGE CAD-4: Mayfield, McLeod & Hall, 1974), and more severe perceived drug-related problems, as assessed by CAGE- inspired measures, are more likely to seek treatment (Ferri, Gossop, Rabe-Hesketh & Laranjeira, 2002).

3.5. Limitations and strengths

The present study presents some limitations that should be taken into account. First, the initial assessment was not always carried out as soon as the patient was admitted to therapy. As noted above, some patients had been in treatment for up to six months before assessment. This delay in the assessment of some of the patients opens the possibility that some early dropouts were never detected, and thus were not included in this study. Although this fact could somewhat limit

generalizability, DO and NDO groups did not differ in their treatment duration when they were initially assessed. It also is important to address that the follow-up assessment only included dropouts occurring during the first year of a two-year treatment protocol. This could imply that the variables identified could be predictive of relatively early outcomes, but not later ones. Results regarding later treatment stages (currently in progress) will be released in future works.

The second limitation relates to the fact that participants received a specific therapy protocol, so results do not necessarily generalize to patients receiving other forms of therapy. In the present case, the fact that therapy was provided by a mutual help association introduces a number of characteristics (for example, the presence of non-professional co-therapists, or the possible occurrence of confrontations between members of the association) that are not present in more standard forms of cognitive-behavioral therapy.

And finally, the study sample size is limited by the inflow of new patients in the treatment center where the study was carried out during a reasonable window of time. Underpowered samples could be liable for some potential predictors not reaching significance, particularly in the regression analysis in the NDO group.

Still, the main strengths of this study are, first, the effort to control for sociodemographic and intellectual prowess variables, quite often disregarded in prospective studies; and second, the assessment of compliance, in a careful, quasi-quantitative way, and independently of dropout; and third, its potential clinical relevance.

CAPÍTULO 4

Gambling, emotion-driven impulsivity and decision-making-under ambiguity in a dynamic learning task

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Juego de azar, impulsividad emocional y toma de decisiones bajo ambigüedad en una tarea dinámica de aprendizaje

4.1. Introduction

Balanced decision-making is crucial for adaptive daily functioning. Consequently, anomalies of decision-making processes are present in a range of psychopathological conditions (Blair, 2013; Dekkers, Popma, van Rentergem, Bexkens & Huizenga, 2016; Rotge, Poitou, Fossati, Aron-Wisnewsky & Oppert, 2017; Tchanturia, Liao, Uher, Lawrence, Treasure & Campbell, 2007). In more direct relation to the aims of the present study, addiction has been described as a disorder of the ability to make good decisions, namely to make choices regarding the potentially addictive behavior (using drugs, gambling) that sacrifice immediate gratification, and overcome impulses, for the sake of more beneficial long-term goals (Bechara & Damasio, 2002; Rachlin, 2000; Verdejo-Garcia, 2017).

Individuals suffering from an addictive disorder persist in a harmful behavior in spite of its negative consequences (e.g. economic losses, health, family and work problems) (DSM-V; APA, 2013). In concordance with this observation, a number of studies have tried to test the prediction that addicted patients present domain-general decision-making alterations that predate the disorder onset (Crowley, 2010; de Bellis et al., 2013; Noël, Brevers & Bechara, 2013;), contribute to its chronicity or complication (Goudriaan, Oosterlaan, de Beurs, & van den Brink, 2008; Lopez-Quintero et al., 2018), or occur as a consequence of the addictive process itself (Churchwell, Lopez-Larson & Yurgelun-Todd, 2010; Schultz, 2011;).

Unfortunately, no universal definition of decision-making exists. In a well-validated and unified framework (Verdejo-García et al., 2018), decisions involve three stages: (1) *preference formation* (reflection, uncertainty evaluation, risk evaluation), (2) *choice implementation* (response initiation, self-regulation and cognitive inhibition), and (3) *feedback processing* (reward and punishment learning, memory and consistency). In this framework, there are several mechanisms that could underlie the inability to exert full control over potentially addictive behaviors. First, addicted or vulnerable individuals could be prone to value more, or to feel more attracted, to options that involve higher risks (during the first stage); to show more interest for superficially attractive rewards (during the second stage); or to be more or less efficient at learning from positive and negative consequences (during the third stage).

The main focus of the present work is *decision-making inflexibility*, defined as the inability to adjust one's choices to dynamically changing reward and punishment contingencies, and its potential role in problematic gambling. Decision-making inflexibility can be regarded as concerning both choice implementation and feedback processing stages. On the one hand,

problematic (or potentially problematic) gamblers could present problems to integrate positive and negative feedback about their gambling decisions, which could lead to poor re-assessment of bad choices, and distorted expectancies about their outcomes (e.g., illusion of control, or overestimation of low chances; Clark, 2017). On the other hand, these gamblers could present difficulties at the moment of implementing choices regarding gambling. Namely, despite their knowledge about the long-term consequences of their addictive behavior, they would be unable to exert volitional control over it (i.e. compulsivity; Bottesi, Ghisi, Ouimet, Tira & Sanavio, 2015; Fauth-Bühler, Mann & Potenza, 2017).

In other words, decision-making inflexibility involves unbalanced learning and/or control. According to contemporary reinforcement learning models (see Dolan & Dayan, 2013, for a review), *model-based* learning, on the one hand, is driven by the updating and refining of mental models of the environment, and allows reflective control. *Model-free* learning, on the other, is driven by simple prediction errors (the contrast between expected and actual reward for our choices), and underlies reflexive (i.e. reflex-like, compulsive) control. Imbalance between these two systems, either during learning or during implementation, would lead to a preponderance of reflexive over reflective behavior.

According to Perales et al., (2019) behavior-specific decision-making inflexibility in disordered gamblers could be due to this type of imbalance between *model-based* and *model-free* control of gambling behavior, driven itself by the reinforcement schedule present in gambling devices and settings. However, it remains unclear whether domain-general individual differences in proneness to this imbalance make people more or less vulnerable to develop addictions in general, or a gambling habit in particular, as shown by animal research (Groman, Massi, Mathias, Lee & Taylor, 2019).

4.2. The Affective Probabilistic Learning Task and problematic gambling

The most pervasively used task to investigate decision-making inflexibility in the lab is the Affective Probabilistic Reversal Learning Task (henceforth, PRLT). In each trial of this task, two choice options are presented to the learner, one advantageous (more likely to ensue reward; e.g. virtual points or money), and the other disadvantageous (more likely to ensue some kind of punishment). Initially, the individual has no other possibility than making her decision at random, but her choices grow attuned to reward and punishment contingencies as the task progress.

However, at some point, and without prior notice, the contingencies are reversed, and the individual needs to update her preferences on the basis of the new contingencies.

This task has been used in gambling research in relation to two non-exclusive hypotheses. On the one hand, as noted above, decision-making inflexibility can be used as an individual-differences measure of compulsivity (Fernández-Serrano, Perales, Moreno-López, Pérez-García & Verdejo-García, 2012; Fernández-Serrano et al., 2012), that is, a proneness of the individual's behavior to rapidly become resistant to extinction, to punishment, and to reward devaluation, after initial reinforcement[1]. On the other hand, from its initial formulation, the PRLT has been described as an emotion-laden task (see Contreras, Catena, Cándido, Perales, & Maldonado, 2008, for a review). In relation to the model-free/model-based distinction described above, Braunstein, Gross, and Oschner (2017) have conceptualized preferences' update in the PRLT as an instance of emotion-regulation task, mostly driven by implicit goals in a partially automatic way. This is similar to the Iowa Gambling Task, in which preferences for advantageous options has been hypothesised to be driven by somatic markers, learnt in a mostly automatic manner (Brevers, Bechara, Cleeremans & Noël, 2013). In other words, the PRLT could be used to investigate, not only the involvement of domain-general compulsivity in disordered gambling, but also its putative relationship with model-free emotion dysregulation. If this approach is correct, the PRLT should be related to other indices postulated as indices of model-free emotion regulation. In principle, this association is not predicted from the mere compulsivity approach.

Unfortunately, previous attempts to compare PRLT performance across groups of individuals without and with addictive behaviors (including disordered gambling) are not free of methodological and interpretational problems. In general, there is no unanimity regarding the best way to measure inflexibility in the PRLT. In a recent meta-analysis and systematic review by van Timmeren, Daams, Van Holst & Goudriaan (2017) it was found that the studies that used the PRLT do not reveal significant levels of behavioral inflexibility in individuals with gambling disorder. However, this could be due to the diversity of procedures and measures used to operationalize PRLT performance. Different studies used, for instance, the amount of money or points earned (de Ruiter et al., 2009; Thompson & Corr, 2013), the number of correct choices

[1] The ability to update preferences for initially reinforced options has been proposed to be model-based, that is, to require explicit knowledge and intentional control (Maia & McClelland, 2004). Accordingly, weakness of model-based control would hinder the individual's ability reacquire preferences after reversal. However, revaluation could also depend on model-free learning of inhibitory associations that are themselves driven by prediction errors ocurring after contigency reversal. In this case, Iinflexible/compulsive decision-making would be caused by faulty interaction between excitatory and inhbitory model-free processes.

(Moreno-López et al., 2015; Torres et al., 2013; Verdejo-Garcia et al., 2015) or the number of consecutive errors after each reversion (i.e. perseverative errors, Ersche, Roiser, Robbins & Sahakian, 2008; Janssen et al., 2015).

4.3. Study aims

In view of these difficulties to interpret previous findings, in the present work we will analyze full acquisition and re-acquisition curves in a PRLT with four phases: one in which initial preferences are first established, and three more resulting from two contingency reversals (Navas, et al., 2015). The first aim was to determine whether group affiliation (patients with problematic gambling vs healthy controls) has any effect on the form of learning curves in each phase, or their variation across phases. Inflexibility can be corroborated by detecting any reacquisition disadvantage in phases with reversed contingencies (2 and 4), relative the ones with contingencies in the original direction (1 and 3). More importantly, we will test whether the effect of contingency reversal depends itself on group (i.e. whether patients show more signs of decision-making inflexibility than controls).

Subsequently, we will specifically analyze patients' performance in relation to the severity of their problematic gambling symptoms. In this study, participants were patients receiving treatment for substance use disorders, who, in addition, showed clinically substantial signs of problematic gambling. By assessing the relationship between gambling severity and PRLT performance, restricted to these patients, we intended to dissociate the effect of problematic gambling from the one of other addictive behaviors.

Lastly, we will also test the putative association between PRLT performance and emotion-driven impulsivity (negative urgency). On the one hand, negative urgency -- and more generally, emotion-driven impulsivity -- has been proposed as a proxy to detect the alteration of model-free emotion regulation (Navas, Billieux, Verdejo-García & Perales, 2019). On the other hand, in the initial phase of the PRLT, the stimuli corresponding to the choice options acquire affective values, and these values need to be dynamically updated when contextual circumstances change. This affective reassessment of choice options has been proposed to depend on context-dependent inhibition of previously learnt associations. According to Braunstein et al. (op. cit.) these processes are, at least partially, model-free. So, if the affective hypothesis regarding PRLT performance is correct, an association is expected between signs of decision-making inflexibility, as defined above, and negative urgency.

Our hypotheses remain open to some extent. Emotion-driven impulsivity is not gambling-specific, but a vulnerability and aggravation factor in almost all externalizing disorders, including addictions (Navas, Billieux, Verdejo-García & Perales, 2019). Hence, from the emotional regulation approximation, it would be expected that people with an addictive disorder, independently of its exact nature, showed a higher level of inflexibility in the PRLT. Complementarily, negative urgency in the group of patients should also be associated with higher levels of inflexibility.

From the behavioral compulsivity approximation, this specific association with negative urgency is not expected. Decision-making inflexibility in reversed contingency phases of the PRLT has been previously reported to be associated with disordered gambling intensity (Torres, Catena, Cándido, Maldonado, Megías & Perales, 2013). This proneness towards compulsivity would explain to some extent the easiness with which disordered gamblers adhere to an initially favorable reinforcement contingency, but are later incapable of abandoning it (Billieux, Van der Linden, Khazaal, Zullino & Clark, 2012; Michalczuk, Bowden-Jones, Verdejo-García & Clark, 2011; Worhunsky, Malison, Rogers & Potenza, 2014). Therefore, from this perspective, PRLT inflexibility would be expected to be linked to higher severity of disordered gambling symptoms, independently of the presence of other addictive disorders and the level of alteration of nonspecific mechanisms of emotional regulation.

4.4. Methods

Twenty-five patients under treatment for substances abuses and how also had gambling disorder were recruited from the rehabilitation centers *Centro de Recuperación Nueva Luz* and *Centro de Recuperación Integral de Alcoholismo y Drogadicción* (CRIAD), from Guayaquil, Ecuador. Convenience sampling was used to recruit twenty-five healthy controls, as closely matched as possible with patients on relevant covariates. Some of the control participants were contacted using announcements in the School of Psychology of the University of Guayaquil, and others were recruited among acquaintances of the patients.

All patients were under treatment for at least one addictive disorder (most of them, for alcohol abuse), and were diagnosed by a clinical psychologist with the DSM-IV diagnostic criteria. The inclusion criteria for both groups were: (1) being between 18 and 65 years old, and (2) no history of head trauma or neurological problems, and not to be diagnosed with any psychiatric or psychological disorder (apart from the addictive disorder in the group of patients). Patients were

included in the sample and considered for further assessments and analyses only if they informed of a previous history of significant problems as a consequence of gambling [corroborated by a score equal or higher than 4 in the South Oaks Gambling Screen (SOGS, Spanish version; Echeburúa, Báez, Fernández-Montalvo, & Páez, 1994)].

4.4.1. Procedure

All participants were assessed in a single session lasting ~2 hours. Patients were assessed in the rehabilitation clinics, and control participants in the premises of the School of Psychology of the University of Guayaquil. All the assessments were performed by an Ecuadorian clinical psychologist with a Master's degree in neuroscience. The assessment protocol was divided into four blocks (cognitive tests, computer-based tests, emotion and personality tests, and a clinical interview). The order of blocks and tasks within each block were counterbalanced for all participants. Some of the instruments were however not relevant for the purposes of this study and will not be described here.

4.4.2. Instruments

4.4.2.1. Gambling severity

The South Oaks Gambling Screen (SOGS, Spanish version; Echeburúa, Báez, Fernández-Montalvo, & Páez, 1994), the questionnaire has been described in section "Instruments" of the chapters 2 and 3.

4.4.2.2. Impulsivity

The UPPS-P brief impulsivity scale (Spanish version, Cándido, Orduña, Perales, Verdejo-García, & Billieux, 2012), the questionnaire has been described in section "Instruments" of the chapters 2 and 3. For the present analysis, only the Negative urgency score will be considered.

4.4.2.3. Reversal learning

The Affective Probabilistic Reversal Learning Task (PRLT, Moreno et al., 2015), is a computer-based decision-making task, in which the participants have to choose, on each trial, between two different stimuli (by mouse-clicking on one of them). The options consist of two squares of different colors that randomly shift their positions in order to prevent an automatic response. The task consists of four phases with 40 trials each. Within each phase, one of the options will be "correct" and, when the participant chooses it, a symbolic reward is given in most occasions (probabilistically). The other option will be "incorrect", and the participant will be notified of the error when choosing it. Participants will be rewarded with virtual points, and punished by subtracting points from their account, and the aim of the task is to accumulate as many points as

possible. In this way, phases 1 and 3 could be considered as phases with the original contingency sign, and 2 and 4 as phases with reversed contingencies. In phases 1 and 2, the proportion of true/false feedback is 87.5/12.5%, whereas in Phases 3 and 4 is 75/25%. This degradation of contingency was introduced to increase uncertainty and thus to avoid close-to-perfect performance in the late phases of the task.

4.5. Statistical analyses

The two groups (patients and controls) were first compared in relevant sociodemographics (Age, Gender composition, Education years, and Monthly income), using Bayesian Mann-Whitney tests, with default priors as implemented in JASP. These analyses were used to select potential confounders to be controlled for when comparing groups in PRLT performance.

PRLT performance was coded trial wise. Each dichotomous response in each trial was classified as correct (1) if the colored square with the higher probability of reward (in the current phase) was chosen, and incorrect (0) if the colored square with the lower probability of reward was chosen (see task description above).

The first PRLT analysis obeyed to a Phase (1, 2, 3, 4) x Trial (1-40) x Group (HC, Patients) design. Response was modeled as binomial variable with a logit link, using Generalized Linear Mixed-effects Models (GLMM), with the *glmer* function implemented in the *lme4* R software package (Bates, Maechler, Bolker & Walker, 2015). This analysis is conceptually similar to a logistic regression, but includes both random and fixed-effects factors, and both within- and between-participant factors as predictors. In the present case, Phase and Trial were used as within-participant fixed factors, and Group as a between-participant fixed factor. Participant was considered as a random-effects factor. Additionally, in order to reduce the number of parameters in the model, Trial was treated as a quantitative variable, and was log-transformed in order to incorporate into the models the general assumption that acquisition processes are curvilinear (in relation to Trial; and can thus be modelled as approximately linear in relation to Log-trial)[2]. To

[2] Actually, the best way to model the effect of trial on the probability of a correct response was determined by model comparison. Three versions of the saturated model in Table 3.2 were compared against each other. In the first (simplest) one, trial entered the model as a fixed slope. In the second one, trial was log-transformed (Log-trial) before entering the model as a fixed slope. Finally, in the most complex model, the effect of trial was decomposed in two polynomial components (linear and quadratic). AIC for the three models were 10510, 10494, and 10504. In other words, the model with Log-trial clearly outperformed both the simplest linear model and the polynomial model. Observed proportions of correct choices as a function of Log-trial are displayed in Figure S3.1 (Supplementary Material).

facilitate convergence, Log-trial was zero-centered with the standard deviation as unit (so Log-trial was expressed in a -3.16 to 1.07 scale; see Figure S3.1 in the supplementary material).

Main effects in this analysis were the ones of Log-trial, Phase, and Group, and the interactions among them. For further interpretation, the effect of Phase was decomposed into three orthogonal contrasts [C1 (-1, -1, 1, 1), C2 (1, -1, 1, -1), and C3 (-1, 1, 1, -1)]. Please note that the contrast portraying evidence regarding learning inflexibility is the second one (C2), as it represents the differential performance in phases with reversed-sign contingencies (second and fourth), relative to phases with the original contingency sign (first and third).

In order to isolate the contribution of each main effect to model fitting, a saturated model was first fitted. This saturated model was contrasted against a simplified one without the Phase x Log-trial x Group interaction, using the Akaike Information Criterion (AIC) and a likelihood ratio test. If the simplified model did not lose fit, it was established as the reference model for further comparisons, and was further simplified by removing the two-way interactions one by one. The same procedure was repeated with marginal effects (Phase, Log-trial, and Group, with the restriction that a marginal effect cannot be removed if it is involved in any of the interactions left in the model in previous steps). Once the best-fitting model was identified, significance of each of the effects in the model was determined using the *z* statistic, with a $p < 0.05$ significance level. A similar procedure was used to detect any substantial marginal or interactive effects of Education years, and incorporate them as covariates in further analysis if necessary.

The second and third analysis were aimed at assessing the contribution of SOGS gambling Severity and Negative urgency to PRLT performance, restricted to the Patients group. A similar backwards hierarchical model fitting procedure was followed, but using SOGS Severity (or Negative urgency) as individual differences factors (instead of group).

In a last analysis, SOGS severity and negative urgency best-fitting models were combined in single model in order to test whether SOGS score and Negative urgency effects on PRLT performance were independent of each other.

4.6. Results

4.6.1. Preliminary analyses

Each group consisted of exactly 18 males and 7 females. Education years and Income were not available for one participant, and those two missing data points were imputed using group means.

Mean and standard deviation for each group in Age, Education years, and the Monthly income scale are shown in Table 4.1. Bayes factors (for the Mann-Whitney U test) yielded support for the alternative hypothesis ($BF_{10} > 3$) for Education years, and for the null $BF_{10} < 1/3$) for Age and Monthly income. In other words, the two groups were well matched in Age and Monthly income, but substantially differed in Education years.

Table 4.1. *Mean and standard deviation for each group in relevant sociodemographics, and Bayes factors, expressed as support for the alternative (BF_{10}), for a non-parametric U test.*

	Group	**Mean**	**SD**	**BF_{10}**
Age	HC	24.96	7.908	0.303
	Patients	25.24	8.428	
Education	HC	14.333	3.131	4.52
	Patients	12.36	2.307	
Income	HC	4.208	1.607	0.317
	Patients	4.04	1.695	

Note. Abbreviation: HC = healthy controls.

4.6.2. Between-groups differences in PRLT performance

Table 4.2 shows results for the hierarchical GLMM analysis. Removing the three-way interaction from the saturated model (Model 1 vs Model 2) did not hamper model fit. However, removing either the Phase x Log-trial or the Group x Log-trial interaction from Model 2 (Model 2 vs Model 3, and Model 2 vs Model 4) did hamper model fit, so those two-way interactions were retained in the best-fitting model. Removing the Group x Phase interaction did not affect model fit (not shown, $p = 0.182$), and the marginal effects cannot be removed because they are involved in the two-way interactions previously retained in the model.

Table 4.3 presents estimates for all effects in the best-fitting model, along with their z-statistics and significance levels, resulting from implementing the model. The directions of these effects are shown in Figure 4.1. Predicted values from the saturated model show, that, as expected, the proportion of correct responses increased with trial within phases; and, second, that healthy controls reached higher proportions of correct responses by the end of each Phase (at the cost of transitory reversal costs by the beginning of phases 2 and 3). Importantly, there was no sign that PGDs presented less correct choices in phases with reversed contingencies (and so the absence of a Group x Phase interaction) in the best-fitting model [the estimate for the C2 x Group effect in the saturated model was -0.056 ($SE = 0.047$, $z = -1.187$, $p = 0.235$)].

Table 4.2. *Between-groups difference in PRLT performance.*

Model	**Fixed factors**	**d.f.**	**AIC**	**logLik**	**χ^2**	***p***
Model 1 (saturated)	Group, Phase, Log-trial, 2-way interactions, 3-way interactions	17	10494	-5230.1		
Model 2	Saturated *minus* 3-way interaction	14	10491	-5231.4	2.463	0.482 (1 = 2)
Model 3	Model 2 *minus* Group x Log-trial	13	10493	-5233.5	4.249	**0.039** (2 > 3)
Model 4	Model 2 *minus* Phase x Log-trial	13	10504	-5241.1	19.43	< **0.001** (2 > 4)
Best-fitting model	Group, Phase, Log-trial, Phase x Log-trial, Group x Log-trial	13	10490	-5233.8		

Note: Degrees of freedom (d.f.), Akaike Information Criterion (AIC), Log-likelihood (logLik), for models relevantly involved in hierarchical GLMM analysis (see text). χ^2 and corresponding *p* values are reported for relevant comparisons between nested models (significant ones marked in bold).

Table 4.3. *Best-fitting model for between-groups differences in PRLT performance.*

Effect	**Estimate**	***SE***	***z***	***P***
Log-trial	0.204	0.033	6.146	**<0.001**
Phase				
C1	-0.149	0.023	-6.347	**<0.001**
C2	-0.232	0.023	-9.902	**<0.001**
C3	-0.042	0.023	-1.805	0.071
Group	-0.155	0.108	-1.433	0.152
Phase x Log-trial				
Log-trial x C1		0.023	-1.307	0.191
Log-trial x C2	0.046	0.023	1.951	0.051
Log-trial x C3	0.087	0.023	3.736	**<0.001**
Log_trial x Group	-0.097	0.047	-2.079	**0.038**

Note: Estimates, standard error (SE), *z*-value and *p*, for fixed effects in the model (significant ones are marked in bold).

In summary, results show that patients showed a slightly poorer performance in the PRLT task, but this worsening did not involve signs of stronger learning inflexibility (differences were not exclusive or relatively larger in phases with reversed contingencies).

4.6.3. PRLT performance as a function of SOGS gambling severity

The patient sample consisted of individuals receiving treatment for substance use disorders who also presented gambling problems. So, in order to test gambling problems in a more specific way, the impact of SOGS gambling severity on PRLT was analyzed in the group of patients. The saturated model (with SOGS, Phase, and Log-trial as fixed-effects factors, and participant as a

random intercept) was first compared against the model without the three-way interaction. Given that the saturated model performed marginally better (AIC = 5283.3, logLik = -2627.7; and AIC = 5281.7, logLik = -2623.9, for the models without and with the interaction; $\chi^2(3) = 7.615$, $p = 0.054$), and for the sake of precision, the saturated model was used for estimation (Table 3.4). Further removing the Group x Phase interaction, did hamper model fit (AIC = 5286.9, logLik = -2632.4, $\chi^2(3) = 9.570$, $p = 0.023$).

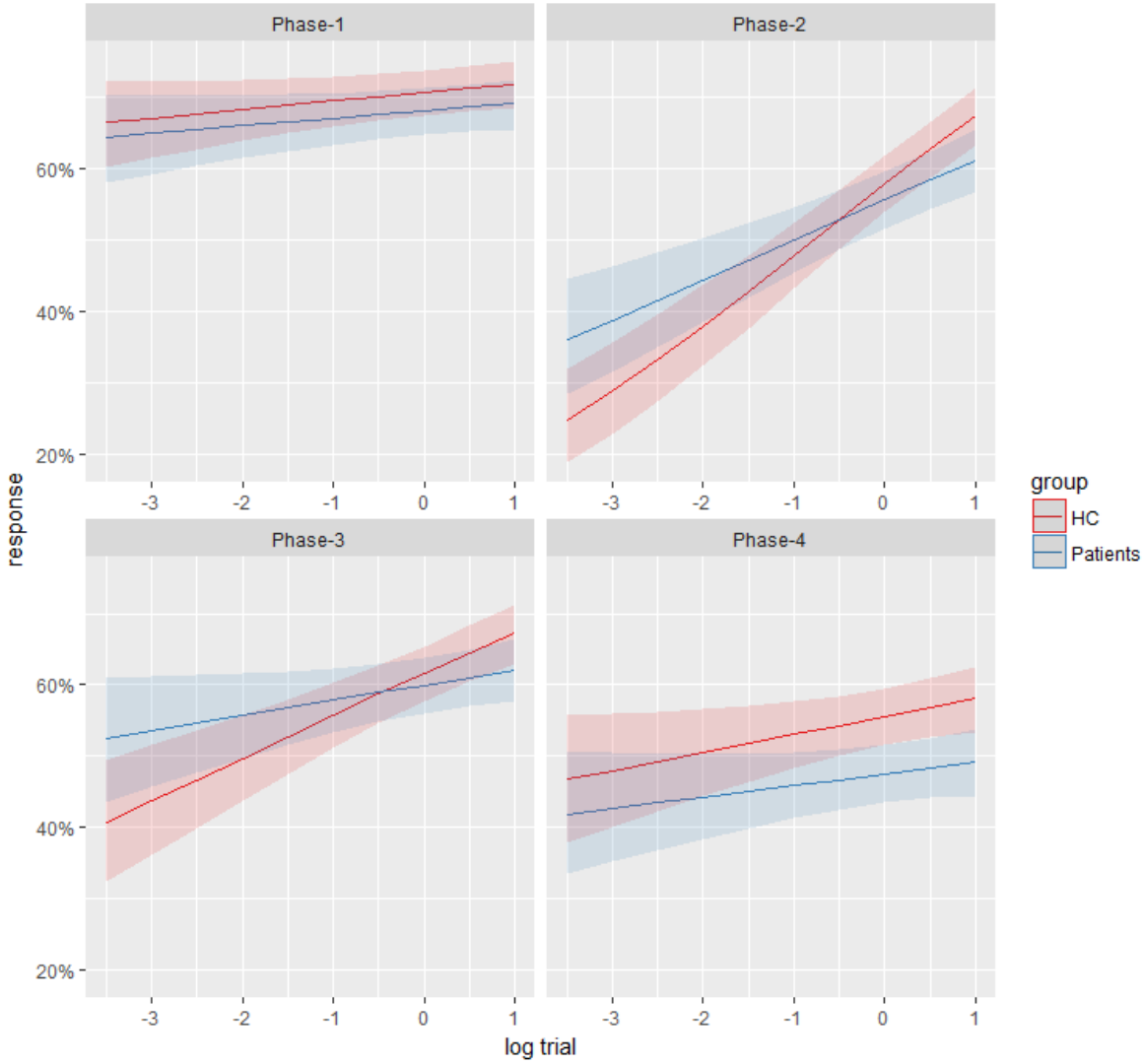

Figure 4.1. Predicted values (and confidence intervals) from the saturated model in Table 4.2, for controls (HC) and patients, across Phase and Log-trial. The vertical axis (response) represents the predicted probability of a correct choice.

Interestingly, SOGS interaction involved only contrast C2 (see Table 4.4), namely the one reflecting learning inflexibility (reacquisition during phases with reversed contingencies, relative to the one in phases with the original contingency sign). As displayed in Figure 4.2, this interaction

is due to a drop in the probability of correct responses associated to higher SOGS scores, in Phases 2 and 4, relative to Phases 1 and 3. This pattern can be straightforwardly interpreted as an increase in learning inflexibility associated to higher SOGS severity.

Table 4.4. *Best-fitting model: PRLT performance as a function of SOGS gambling severity*

Effect	**Estimate**	***SE***	***z***	***p***
SOGS	-0.045	0.091	-0.489	0.625
Log-trial	0.073	0.042	1.732	0.083
Phase				
C1	-0.145	0.042	-3.429	**0.001**
C2	-0.191	0.042	-4.504	**<0.001**
C3	0.031	0.042	0.731	0.465
Log-trial x SOGS	0.048	0.036	1.306	0.191
SOGS x Phase				
SOGS x C1	-0.036	0.036	-0.993	0.321
SOGS x C2	-0.094	0.036	-2.616	**0.009**
SOGS x C3	-0.052	0.036	-1.449	0.147
Log-trial x Phase				
Log-trial x C1	-0.020	0.042	-0.479	0.632
Log-trial x C2	-0.026	0.042	-0.623	0.534
Log-trial x C3	0.023	0.042	0.543	0.587
SOGS x Log-trial x Phase				
SOGS x Log-trial x C1	-0.015	0.036	-0.414	0.679
SOGS x Log-trial x C2	0.092	0.036	2.513	**0.012**[a]
SOGS x Log-trial x C3	0.040	0.036	1.111	0.267

Note: Estimates, SE, *z*-value and *p*, for fixed effects in the model. [a] Despite the significance of this contrast, the three way interaction did not reach significance in hierarchical comparisons.

4.6.4. PRLT performance as a function of negative urgency

The saturated model (with Negative urgency, Phase, and Log-trial as main fixed-effects factors, and participant as a random intercept) did not perform better than the nested one without the three-way interaction (AIC = 5282.1, logLik = -2627.1; and AIC = 5286.8, logLik = -2626.4, for the models without and with the three-way interaction, respectively; $\chi^2(3) = 1.359$, $p = 0.713$). Further removal of the Log-trial x Phase and the Log-trial x interactions did not hamper model fit either (AIC = 5281.0, logLik = -2629.5, $\chi^2(3) = 4.851$, $p = 0.183$; and AIC = 5281.2, logLik = -2627.6, $\chi^2(3) = 1.044$, $p = 0.307$). However, the Negative urgency x Phase interaction did contribute substantially to model fit (AIC = 5287.1, logLik = -2632.6, $\chi^2(3) = 10.968$, $p = 0.012$). The fixed part of the best-fitting model thus consisted of Negative urgency, Phase, Log-trial, and the Negative urgency x Phase interaction. As shown in Table 3.5, the Negative urgency x Phase interaction only involved Contrast 2.

As displayed in Figure 4.3, this interaction is due to a drop in the probability of correct responses associated to higher Negative urgency scores, in Phases 2 and 4, relative to Phases 1 and 3. Again, this pattern that can be interpreted as an increase in learning inflexibility associated to negative urgency SOGS severity.

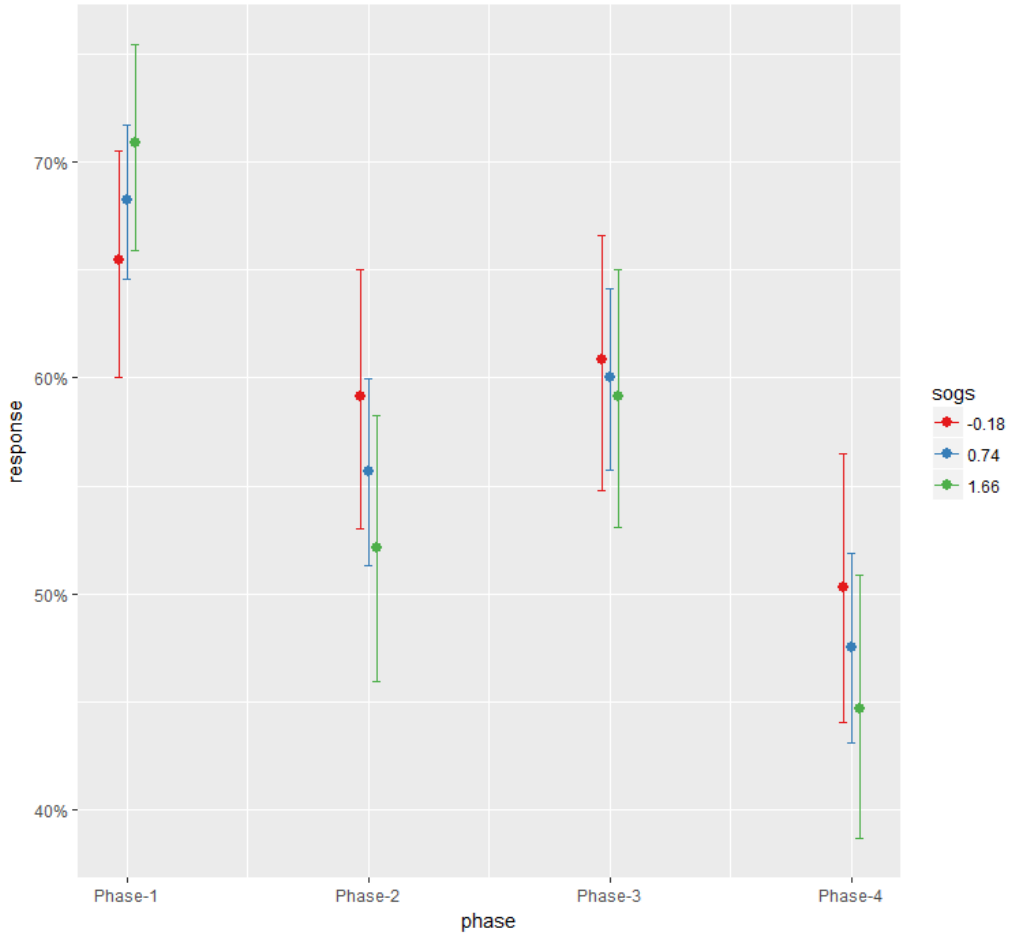

Figure 4.2. Predicted values (and prediction confidence intervals) for the Phase x SOGS interaction from the saturated model in Table 4.4. SOGS reference values were automatically selected as high, intermediate, and low.

4.6.5. PRLT performance as a joint function of SOGS severity and Negative urgency

Finally, a last saturated model was fit with Phase, Log-trial, their interaction, and the Phase x SOGS and Phase x Negative urgency interactions (AIC = 5280.8, logLik = -2623.4). The model lost fit when the Phase x SOGS interaction was removed (AIC = 5283.0, logLik = -2627.5, $\chi^2(3) = 8.260$, $p = 0.041$), as well as when the Phase x Negative urgency interaction was removed (AIC = 5284.5, logLik = -2628.3, $\chi^2(3) = 9.747$, $p = 0.021$). The coefficients for the interaction of SOGS severity and Negative urgency with Phase contrast C2 were -0.077 (SE = 0.037) and -0.091 (SE =

0.037). These coefficients are only slightly lower than in Tables 4.4 and 4.5, which suggests that the two effects are mostly independent of each other.

Table 4.5. *PRLT performance as a function of negative urgency.*

Effect	Estimate	SE	z	p
Negative urgency	-0.079	0.092	-0.857	0.392
Log-trial	0.109	0.033	3.331	0.001
Phase				
C1	-0.178	0.034	-5.175	**<0.001**
C2	-0.233	0.034	-6.783	**<0.001**
C3	-0.019	0.034	-0.566	0.571
Negative urgency x Phase				
SOGS x C1	0.021	0.036	0.583	0.560
SOGS x C2	-0.107	0.036	-2.950	**0.003**
SOGS x C3	0.048	0.036	1.331	0.183

Note: Estimates, standard error (SE), *z*-value and *p*, for fixed effects in the best-fitting model (significant ones are marked in bold).

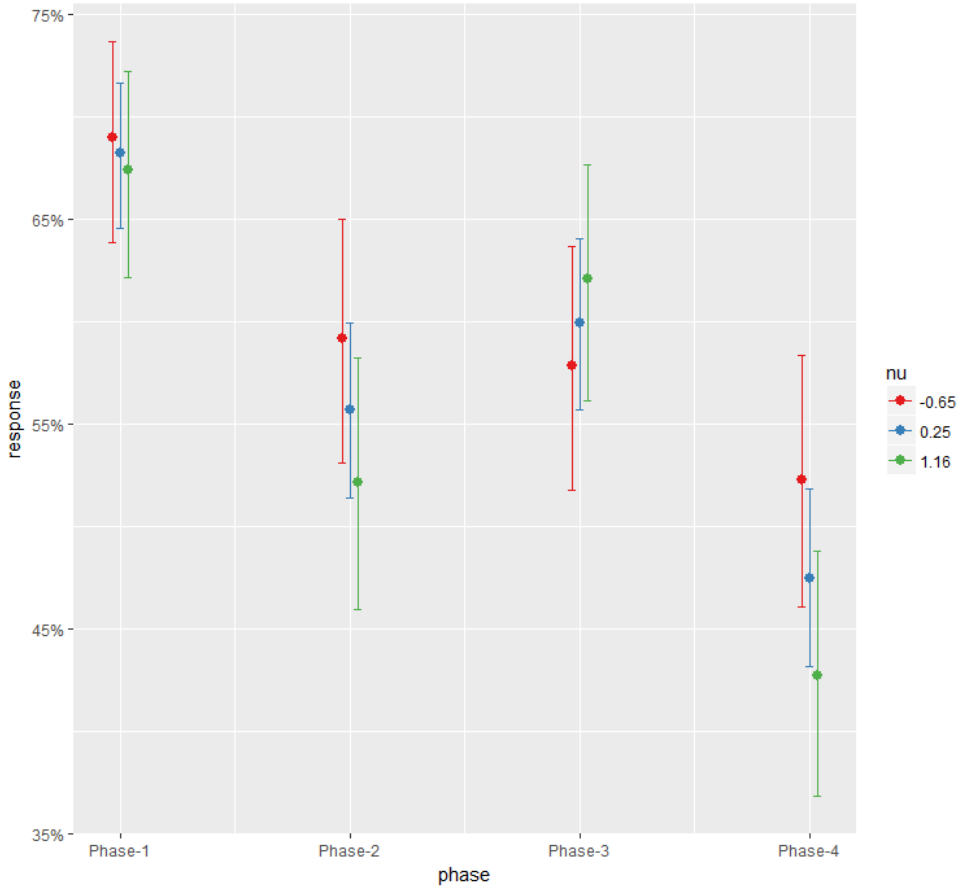

Figure 4.3. Predicted values (and prediction confidence intervals) for the Phase x Negative urgency interaction from the saturated model in Table 4.5. Negative urgency reference values were automatically selected as high, intermediate, and low.

4.7. DISCUSSION

The first aim of the present study was to corroborate the existence of PRLT differences, and, more specifically, signs of decision-making inflexibility, in a group of patients with addictive disorders and gambling problems, relative to matched controls. As depicted in Figure 4.1 (see also Figure S3.1 in the Supplementary Material), patients showed less steep within-phase learning functions, so that they were consistently less likely to make correct choices (i.e. to select the option with a larger probability of reward and a lower probability of punishment), by the end of each phase. In other words, patients reached lower learning asymptotes (or took longer to reach them), a result virtually identical to the one reported by Moreno-López et al. (2015), and Torres et al. (2013), with cocaine-dependent individuals, and by Robinson (2018), with patients with methamphetamine use disorder. However, and also in line with these studies, there were no specific drops of learning efficiency in phases with reversed contingencies (phases 2 and 4), relative to non-reversed ones (phases 1 and 3). In other words, addiction chronicity seems to have quite a generalized deleterious effect on feedback-based decision-making but does not make this learning necessarily more inflexible. Still, the possibility exists that these global effects have masked or overshadowed subtler signs of trait-compulsivity, rendering them undetectable.

Results were contrastingly different when PRLT performance was analyzed as a function of gambling severity (measured with the SOGS questionnaire). As shown in Figure 4.2. patients with stronger disordered gambling symptoms made substantially fewer correct choices in phases 2 and 4, relative to phases 1 and 3. Or, more precisely, although participants, independently of the severity of their gambling, tended to perform worse in reversed contingency phases than in non-reversed ones, the more severe gambling was, the more marked this pattern grew. This result also aligns with the ones from the study by Torres et al. (2013), in which gambling intensity (monthly use) was associated to increased reversal costs, restricted to reversed-contingency phases. To our knowledge, the only study in which this pattern has been reported in patients with substance use disorders is the one by Moreno-López et al. (2015), where reversal learning deficits were observed to be associated with cocaine use severity and diminished cerebellar gray matter volume.

Very similar reversal learning deficits were also observed to be associated with individual differences in negative urgency. As noted earlier, according to Braunstein et al., (2017), preference updating in the PRLT is one of the reward/punishment-based learning phenomena (along with extinction and reinforcer revaluation) that can be characterized as mostly implicit and automatic (or model-free, in Etkin, Büchel & Gross, 2015, terminology). Elevated levels of negative urgency have been consistently reported in samples of individuals suffering from

addictive disorders and related psychopathologies (Fischer, Settles, Collins, Gunn & Smith, 2012; Settles et al., 2012), and the feelings-trigger-action component of negative urgency has been proposed as a transdiagnostic underlying factor for externalizing disorders (Johnson, Carver & Joormann, 2013; Carver, Johnson, Joormann, Kim & Nam, 2011; Johnson, Tharp, Peckham, Carver & Haase, 2017). Navas et al. (2019) have proposed model-free emotion-regulation tasks and negative urgency assessments to tap on similar processes but, to date, this hypothesis had never been directly tested. The association between PRLT decision-making inflexibility and negative urgency reported here clearly aligns with this hypothesis.

Interestingly, these two sets of associations, between PRLT inflexibility and SOGS severity, on the one hand, and between PRLT inflexibility and negative urgency, on the other, were mostly non-overlapping. That is, the reversal deficit-SOGS links survived after controlling for negative urgency, and *vice versa*. This partial independence probably implies that the PRLT, despite being originally presented as a simplified alternative to the Iowa Gambling Task (Fellows & Farah, 2003; see also, Fellows & Farah, 2004), taps on several mental processes. On the one hand, effects on general learning efficiency, mostly revealed from asymptotic differences (in any of the two directions; see Verdejo-Garcia et al., 2010) can be dissociated from effects on reversal deficits, that is, from specific difficulties in learning reversed contingencies. And, on the other, specific reversal deficits can be themselves multifactorial. As shown here, they can be sensitive to emotion-regulation individual differences, but also to degrees of gambling severity, when such individual differences are controlled for: value updating of choice options seems to be hindered in gamblers, but even (additively) more in those presenting impulsive reactions to emotional triggers.

Beyond these effects, this work also presents some methodological advances. So far, PRLT performance had been assessed either by extracting summary performance indices (e.g. number of perseverative errors; Janssen et al., 2015; Ersche, Roiser, Robbins & Sahakian, 2008) or analyzing learning curves in a blockwise fashion (number of correct responses per 5-trial or 10-trial block: Torres et al., 2013; Moreno-López et al., 2015). To our knowledge, this is the first time PRLT performance is analyzed by considering every single response in the task and, trying to experimentally model it in full.

As noted earlier, summary parameters are not free of interpretation problems. For instance, as clearly observed in Phases 2 and 3 displayed in Figure 4.1, individuals reaching higher learning asymptotes in the preceding phase tend to perform transitorily worse in the first trials of the ongoing phase. This means that assessing decision-making inflexibility by means of perseverative errors is likely to confound ‘true’ and ‘apparent’ perseverative errors, with the latter

being attributable to pre-reversal differences. Blockwise analyses, in turn, are likely to be insensitive to effects that occur in the trial-by-trial scale. Moreover, our trialwise analyses of responses allows to model them as they really are, dichotomous (0/1) responses, instead of response counts (number of perseverative errors, number of correct choices per block) with distributional features that are seldomly taken into account in standard, general linear model-based analyses.

Taken together, results fit well in the *Gambling Space Model* formulated by Navas et al. (2019). In this model, articulated as a development of the seminal *Pathways Model* (Blaszczynski & Nower, 2002), transition from recreational to disordered gambling is driven by the kind of reinforcement schedules that have been experimentally shown to also facilitate transition from goal-driven to compulsive behaviors. This transition towards 'gambling-specific' compulsivity can be speeded or made more likely in vulnerable individuals showing trait-like signs of compulsivity (as also shown by animal translational research; Fineberg et al., 2010). Given that, in gambling disorder, there is no chemical agent to hijack reinforcement circuits, individual differences in compulsivity proneness could play a larger role than in substance use disorders. Tentatively, this could explain why signs of compulsivity are easier to detect in patients with gambling disorder than in other populations of addicts, and also why, in the present study, decision-making inflexibility did not emerge in the between-group comparison, but did when gambling severity was specifically taken into consideration.

Apart from the gambling-specific compulsivity that is common to all individuals suffering from gambling disorder, the Gambling Space Model hypothesizes the existence of several dimensions that would account for clinically-relevant individual differences among gamblers. One of them, generalized emotion dysregulation is defined as a significant alteration of model-free regulation of negative emotions, and is proposed to manifest as an elevation of negative urgency and a higher risk of comorbidities in the externalizing disorders spectrum. Although a cluster of disordered gamblers showing a pattern of elevated emotional impulsivity, antisocial behaviors, and poor prognosis is described in detail in the gambling literature (Milosevic & Ledgerwood, 2010), a direct association between negative urgency and performance in a lab task neuro-cognitively linked to model-free emotion dysregulation had not been tested to date. Our results reinforce the idea that negative urgency and PRLT inflexibility have a common model-free emotion dysregulation component, although further research is warranted to characterize the nature, extent, and generalizability of such overlapping.

CAPÍTULO 5

Conclusiones generales, implicaciones clínicas y observaciones finales.

5.1. Conclusiones generales

El objetivo general de este trabajo ha sido avanzar en la comprensión de la implicación de la impulsividad de base afectiva y la regulación emocional en el desarrollo, mantenimiento y patologización del juego de azar, incidiendo en algunos de los aspectos en los que la investigación previa aún tenía lagunas importantes. Las brechas identificadas incluían: (1) el estudio transcultural de la implicación de esos constructos en el juego, (2) su exploración como predictoras de abandono y cumplimiento terapéutico, y (3) el uso de tareas de laboratorio, y en concreto la PRLT, como instrumentos sensibles a sus mecanismos neurocognitivos.

Los estudios de esta tesis (Capítulos 2, 3, y 4) abordan individualmente cada uno de estos objetivos. Los resultados de los tres estudios pueden encontrarse resumidos en la Figura 5.1, que representa las asociaciones específicas (controladas mutuamente y por factores sociodemográficos) entre las variables usadas en cada estudio. En el primero de ellos se comprobó que las relaciones entre impulsividad emocional (medida con la UPPS-P), las estrategias de regulación emocional (ERQ), los sesgos cognitivos (GRCS), la severidad del juego (SOGS) y la presencia de problemas comórbidos con el uso de alcohol y drogas ilegales (MultiCAGE CAD-4) se aproximan mucho a las predicciones del modelo GSM. Se encontraron asociaciones de la severidad del juego de azar con la mayoría de los indicadores de impulsividad y de distorsiones cognitivas, así como con los problemas derivados del uso de alcohol y otras drogas, lo que muestra la relevancia de todas estas variables en la caracterización del TJA. Teóricamente más relevantes son las asociaciones (1) de la urgencia negativa con el uso de la supresión y (menos consistentemente), con los problemas con el alcohol; (2) de la búsqueda de sensaciones con el conjunto de distorsiones cognitivas del GRCS, y de la urgencia positiva, más específicamente, con los sesgos cognitivos del GRCS; y (3) del uso de la reevaluación con los sesgos cognitivos del GRCS. Este patrón de relaciones refuerza la naturaleza motivacional-emocional de los sesgos cognitivos y su vinculación con las estrategias de regulación emocional que, de forma hasta cierto punto paradójica, predice el GSM.

El GSM es un modelo de inspiración psicobiológica. Por tanto, la corroboración en muestra ecuatoriana de las relaciones entre los constructos que postula el modelo refuerza la idea de que dichos constructos son consustanciales a la generación de variabilidad individual entre jugadores. Sin embargo, ello no quiere decir que la conducta de juego se manifestará de igual manera a través de contextos culturales. Las tipologías concretas de jugadores, esto es, las zonas de concentración dentro del espacio dimensional propuesto por el modelo, pueden variar en función de otras variables individuales y ambientales. Primero, la disponibilidad de oportunidades de jugar puede

variar a través de contextos, dando más o menos oportunidad a su condicionamiento. Segundo, distintas variantes culturales del juego a través de contextos proporcionan distintas fuentes de reforzamiento, que implican directamente a las dimensiones del modelo relacionadas con las propiedades del juego como reforzador negativo o positivo. Tercero, la implicación diferencial de personas con mayores o menores recursos cognitivos y educativos puede dar lugar a una mayor o menor vulnerabilidad a los sesgos cognitivos, en un sentido, hasta cierto punto, paradójico. Y cuarto, la prohibición puede contribuir a atraer al juego a personas con un perfil de mayor riesgo para incurrir en conductas ilegales, como ocurre con las personas adictas a sustancias ilegales (White, Tice, Loeber y Stouthamer-Loeber, 2002), esto es, a provocar la aparición de una mayor proporción de jugadores impulsivos en la población total de jugadores. Esta última posibilidad resulta de especial interés en el estudio del juego de azar en Ecuador debido a que el juego de azar en dicho país es ilegal (desde el 2011). Esta restricción puede que atraiga a un perfil de jugador en general más problemático.

En el segundo estudio, la urgencia positiva resultó ser el único predictor de abandono del tratamiento y la urgencia negativa calló justo por debajo del umbral de decisión. Mientras que una menor puntuación en la búsqueda de sensaciones, un mayor grado de disforia y un mayor grado de conciencia sobre el problema de juego se mostraron como predictores del cumplimiento de las asignaciones terapéuticas. En relación a este estudio, es importante hacer notar que no se cumplieron exactamente las predicciones del modelo respecto de la posible implicación de la urgencia negativa en el riesgo de abandono y en el grado de cumplimentación de las actividades terapéuticas. Es posible que las personas con altos niveles de urgencia negativa sean menos propensas a buscar tratamiento (Patkar, 2004), o lo hagan por otros problemas comórbidos (p. ej., otros trastornos adictivos). Los resultados del estudio 1 apuntan en esta dirección, y señalan la importancia de hacer estudios específicos dirigidos a corroborar la posible relación entre desregulación emocional generalizada y motivación para la búsqueda de tratamiento.

Los resultados del estudio sí son compatibles con la idea de que los jugadores que ya están en tratamiento pueden permanecer, durante un periodo de tiempo largo, ambivalentes en lo que se refiere a su decisión de mantenerse en tratamiento (y, por tanto, abandonar el juego indefinidamente). Sztainert y cols. (2014) han resaltado la importancia de los reforzadores positivos en la resistencia a buscar tratamiento. Nuestros datos revelan que las dimensiones de la impulsividad relacionadas con procesos apetitivos (urgencia positiva y búsqueda de sensaciones) predicen un mayor abandono o un menor cumplimiento de las asignaciones terapéuticas (ver también, Aragay y cols., 2015; Jiménez-Murcia y cols., 2012), y que esa tendencia puede ser

contrarrestada en parte por una mayor conciencia de los problemas derivados del juego. Nuestros datos apuntan, por tanto, a la importancia de trabajar dicha ambivalencia, particularmente en aquellas personas que mantienen motivos apetitivos para continuar jugando. Dicha contribución es de gran relevancia y permite tomar en cuenta las características que los pacientes deben desarrollar o fortalecer para su rehabilitación.

En el tercer estudio se pudo observar que, en la ejecución de la PRLT, tanto el grupo de pacientes como los controles sanos tenían respuestas correctas que aumentaban con cada ensayo dentro de las fases, sin embargo, el grupo de controles sanos alcanzó niveles más altos de aprendizaje (mayor número de decisiones correctas) al final de cada fase. Por otro lado, al analizar el rendimiento en la PRLT en relación al SOGS, se encontró que una mayor severidad por el juego de azar se asocia a una mayor inflexibilidad en el aprendizaje, esto es, a una menor eficiencia en la readquisición de preferencias en las fases de la tarea con contingencias invertidas. Del mismo modo, también se pudo observar que un incremento similar de la inflexibilidad asociada a la urgencia negativa. Y finalmente los resultados muestran que los efectos de la urgencia negativa y del SOGS en el desempeño de la PRLT son al menos parcialmente independientes.

Estos resultados muestran, por un lado, que la severidad en el juego de azar está asociada con la inflexibilidad en el aprendizaje, hallazgo que también ha sido reportado en consumidores de cocaína (ver Moreno-López y cols., 2015). Al parecer, la cronicidad de la adicción parece tener un efecto perjudicial bastante generalizado en la toma de decisiones basada en la retroalimentación. Por otro lado, la relación entre la urgencia negativa y la inflexibilidad en la PRLT muestra que los pacientes con mayores dificultades en la regulación emocional presentarían dificultades para extinguir las preferencias adquiridas y actualizarlas sobre la base de las nuevas contingencias, tal y como proponen Braunstein y cols. (2017). Estos datos, considerados de forma conjunta con los del primer estudio, sugiere una alta prevalencia de un subtipo de jugadores en Ecuador con un alto grado de impulsividad, con comportamientos antisociales y con mal pronóstico. Tal como se mencionó anteriormente es probable que las características propias de la condición legal de los juegos de azar y en general de otras actividades ilícitas sea más atractivo para personas más impulsivas y con una escasa flexibilidad en el aprendizaje afectivo.

Del mismo modo, este estudio pudo avanzar en otros dos aspectos: en primer lugar, presenta avances metodológicos en el análisis del rendimiento de la PRLT, que hasta el momento ha sido analizada a partir de indicadores parciales (respuestas correctas o incorrectas por bloques, número de errores perseverativos, etc.). En nuestro estudio se consideraron todas las respuestas de la tarea y se modelaron experimentalmente en su totalidad. El segundo avance se da en relación a

la hipótesis de Navas y cols., (2019) en la que propusieron tareas de regulación emocional *model-free* y evaluaciones de urgencia negativa para aprovechar procesos similares y así poder detectar la desregulación emocional *model*-free, que hasta el momento había sido difícil de evaluar con tareas psicométricas o de laboratorio, por ser un mecanismo automático y no consiente.

5.2. Implicaciones clínicas

Los resultados del estudio 1 vienen a corroborar los de estudios anteriores en lo que se refiere a la importancia de tomar en consideración las diferencias individuales para entender la clínica del TJA. Más específicamente, de acuerdo con las predicciones del GSM (ver Tabla 1 en Navas y cols., 2019), se encontró una asociación de la urgencia negativa con el riesgo de comorbilidades en el ámbito del uso de sustancias, y con un mayor uso de la supresión (que, a su vez, también se asocia a un mayor riesgo de psicopatología). En otras palabras, el subgrupo de jugadores con una mayor desregulación emocional generalizada (en gran medida coincidentes con los jugadores impulsivos-antisociales del *Pathways Model*, ver Figura 1.1) presentaría niveles más altos de sobre-patologización y complicación del juego.

Algunos trabajos previos (Knezevic-Budisin, Pedden, White, Miller y Hoaken, 2015; Maccallum, Blaszczynski, Ladouceur y Nower, 2007) señalan las dificultades específicas que se presentan en el tratamiento de este tipo de pacientes, en los que la baja disponibilidad de mecanismos básicos de regulación emocional hace que las situaciones de alto impacto emocional sobrecarguen su capacidad ejecutiva y, por tanto, la posibilidad de usar estrategias más deliberativas (Navas y cols., 2017a). En estos casos, las técnicas de *mindfulness*, integradas en la terapia cognitivo-conductual han demostrado tener eficacia en problemas adictivos con desregulación emocional comórbida (Hoppes, 2006), del mismo modo hay evidencia de su eficacia en pacientes que presentan una pobre ejecución en tareas de toma de decisiones relacionadas con regulación emocional (Alfonso, Caracuel, Delgado-Pastor y Verdejo-García, 2011).

La asociación de la reevaluación (una estrategia de regulación emocional habitualmente considerada adaptativa, e incluida con frecuencia en los paquetes de terapia cognitivo-conductual) con una sintomatología cognitiva más intensa (mayores sesgos cognitivos), también tiene implicaciones importantes. Es muy probable que las personas que utilizan estos mecanismos de auto-reafirmación sean particularmente refractarias a las técnicas de reestructuración cognitiva. En relación a ello, una solución, probablemente, estaría dada por el entrenamiento de las

habilidades metacognitivas, la cual les permitiría a los pacientes ser conscientes de la conexión entre sus creencias disfuncionales y sus motivos para jugar (ver Lindberg, Fernie y Spada, 2011)

Entre las especificidades culturales (en población ecuatoriana) de las manifestaciones clínicas de las dimensiones del modelo está, aparentemente, una mayor dificultad para corroborar la relación entre urgencia negativa y comorbilidades en el dominio del abuso de drogas. Esta dificultad puede venir provocada por las peculiaridades del juego en Ecuador. Los jugadores con TJA en Ecuador con frecuencia recurren a casinos virtuales en servidores fuera del país (ver Gainsbury y cols., 2013; para una revisión de como los juegos de azar por internet contribuyen con el problema y patologización del juego de azar), o cruzan la frontera hacia el país vecino, tomando mayores riesgos y destinando mayores recursos para conseguir apostar. Este tipo de jugador suele llegar a las clínicas de rehabilitación por problemas de consumo de alcohol o drogas, debido a que en Ecuador no existen centros de rehabilitación especializados para tratar el TJA[3]. De igual modo, los jugadores, incluso no patológicos, presentan con mayor probabilidad otras conductas de riesgo. Esto es, la prohibición del juego parece atraer a un perfil de jugador potencialmente más problemático, lo cual puede haber disminuido en nuestra muestra el rango de variabilidad en el constructo de desregulación generalizada, dificultando la constatación de correlaciones fuertes.

El estudio 2, por su parte, muestra que las personas aparentemente más sensibles a motivos y estímulos apetitivos (caracterizadas por puntuaciones más altas de urgencia positiva y búsqueda de sensaciones) son más tendentes a abandonar o no cumplimentar adecuadamente el tratamiento. Estos resultados resaltan la importancia de valorar los motivos apetitivos para el juego y la conciencia del problema como indicadores de riesgo de abandono/adherencia, y la necesidad de abordar la ambivalencia motivacional como parte consustancial de las primeras fases de la terapia. El hecho de que la ambivalencia motivacional sea especialmente intensa en personas con puntuaciones altas en variables relacionadas con los aspectos apetitivos del juego indica, por otra parte, que estas características podrían ser especialmente relevantes en ciertos subgrupos de jugadores. Como se ha descrito con anterioridad (ver también Navas y cols., 2017b), los motivos apetitivos son especialmente prevalentes en jugadores jóvenes de juegos de habilidad, casino, cartas y apuestas (tipo I), y en jugadores de juegos de azar online (ver Jiménez-Murcia y cols.,

[3] A partir de que se prohibiera el juego de azar en Ecuador, las clínicas y grupos de apoyos también cerraron sus puertas (un antecedente inusual, debido a que no se prohibía el cierre de clínicas, sino el cierre de casinos y casas de apuestas), esto ocasionó que el problema se invisibilizara en el país.

2019). Existen técnicas de intervención específicas, como la entrevista motivacional, que permiten abordar la ambivalencia hacia el tratamiento (Arkowitz, Miller y Rollnick, 2015; Rollnick y Miller, 1995). Nuestra propuesta es que estas técnicas podrían utilizarse como herramientas de abordaje temprano del juego potencialmente problemático en población joven y en contextos educativos, como complemento a la psicoeducación en el juego que normalmente se implementa en estos casos.

Por último, los resultados del estudio 3 nos remiten a la necesidad de trabajar funciones cognitivas genéricas en poblaciones de personas con adicción. Nuestros datos sugieren una incidencia más alta en jugadores con TJA que en la población de referencia de alteraciones de las funciones cognitivas relacionadas con la flexibilidad del aprendizaje, pero, al mismo tiempo, otros estudios muestran que estas alteraciones no son comunes a todos los pacientes con trastornos adictivos. Ello quiere decir que su correcta evaluación podría servir para identificar a aquellos pacientes en los que la intervención neuropsicológica podría ser beneficiosa. Algunos trabajos recientes han explorado cómo este tipo de intervención podría extenderse al tratamiento de los trastornos adictivos. Por ejemplo, se han diseñado herramientas de entrenamiento cognitivo basadas en tecnología móvil destinadas a pacientes con alcoholismo. este entrenamiento se realizó específicamente en la memoria de trabajo, atención y, además, también, se utilizaron ejercicios de razonamiento lógico (como intervención neuropsicológica con el programa “mHealth”) permitiendo presenciar reducciones significativamente mayores de la disfunción ejecutiva (Bell, Vissicchio y Weinstein, 2016). Por otro lado, al parecer el entrenamiento neurocognitivo en general también permite en la etapa de abstinencia una creciente evidencia de la neuroplasticidad (Manning, Verdejo-Garcia y Lubman, 2017). El reentrenamiento de los sesgos cognitivos también ha sido otra técnica que ha demostrado eficacia en personas con trastornos adictivos (Christiansen, Schoenmakers y Field, 2015).

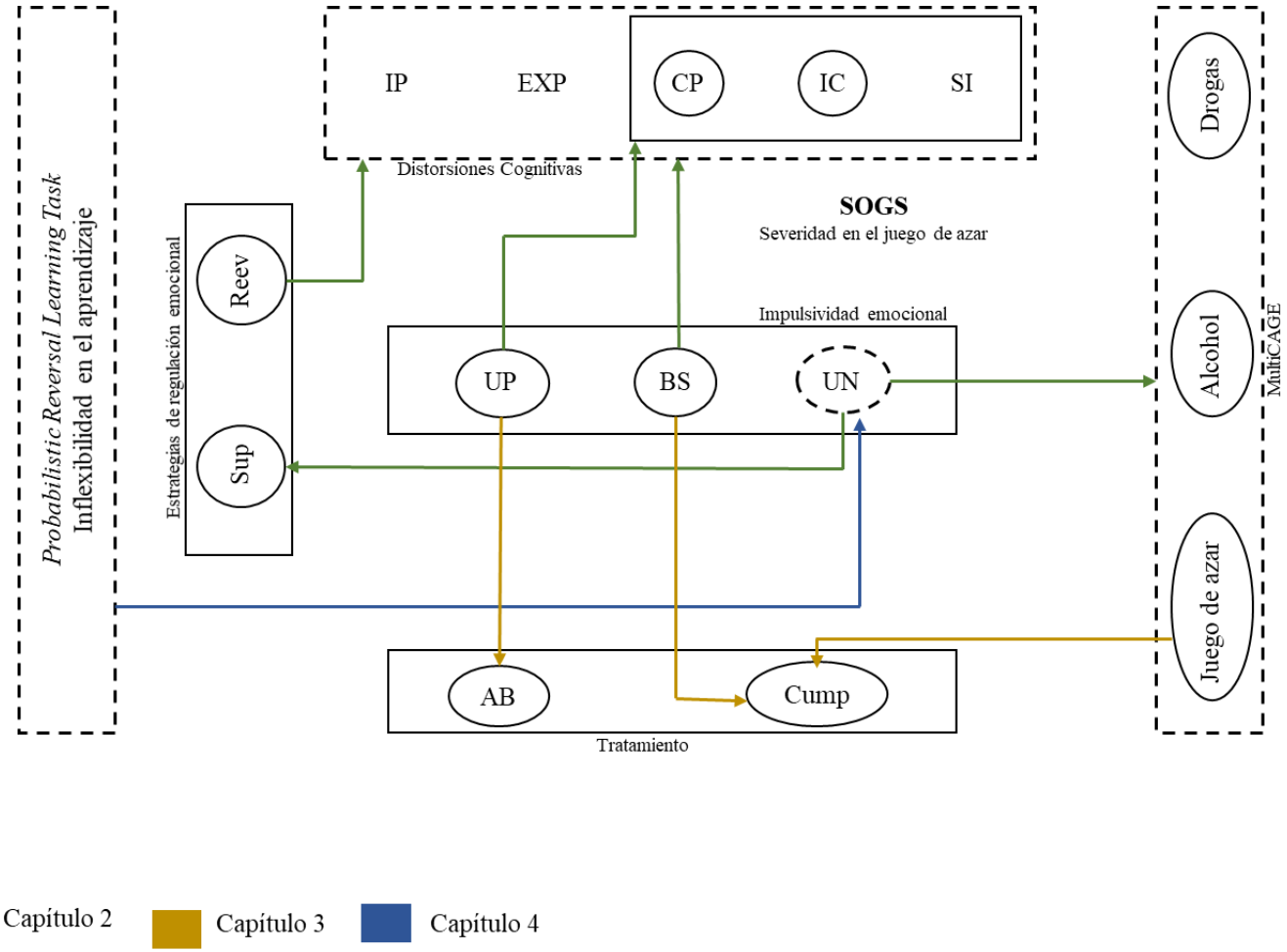

Figura 5.1. Resumen de los hallazgos principales de los 3 estudios. Nota: Las cajas con líneas discontinuas especifican las variables o conjuntos de ellas que muestras asociaciones específicas con la severidad del juego (SOGS). Abreviaturas: IP, EXP, CP, IC y SI (GRCS; incapacidad para parar, expectativas en el juego, control predictivo, ilusión de control, sesgo interpretativo), UP, UN, BS (UPPS-P; urgencia positiva, urgencia negativa, búsqueda de sensaciones), AB y Cump (abandono y cumplimiento del tratamiento), Sup y Reev (ERQ; supresión y reevaluación).

6.3. Observaciones finales

La generalidad de las propiedades neurobiológicas del TJA no implica que éste no se adapte a los diferentes contextos culturales y legales, tal y como se ha discutido a lo largo de este trabajo. Por esta razón, resulta imprescindible que el trastorno por juego de azar sea abordado de una forma culturalmente inclusiva. Esa necesidad contrasta con la tendencia de un buen grupo de equipos de investigación a ignorar o despreciar la importancia de los factores socioculturales en sus estudios.

Esta tendencia es en parte responsable de la ausencia de cifras más exactas sobre prevalencia del juego de azar problemático a nivel mundial y de su falta de visibilidad. Desarrollar estas líneas de investigación permitiría implementar estrategias de intervenciones psicoeducativas de prevención del juego de azar problemático y su patologización, lo que facilitaría que los pacientes con TJA puedan recibir un tratamiento adecuado en estos países.

Por otra parte, los datos transculturales pueden inspirar las políticas que se implantan en distintos países. Aquí se han discutido las posibles consecuencias negativas de la prohibición del juego, y como ésta puede interactuar negativamente con las vulnerabilidades propias de los individuos. Pero estudios como éste también permiten poner en perspectiva las características del contexto cultural del juego en los países desarrollados. Por ejemplo, las consecuencias de la escasa regulación del juego en estos países y sus consecuencias también pueden manifestarse más claramente a partir de la comparación transcultural. Estudios como el de Navas y cols. (2017b) sugieren que el grado de exposición de los individuos al juego, vía publicidad y disponibilidad, interactúa con los mecanismos psicológicos de regulación de las emociones, afectando negativamente a la recuperación de los pacientes, y somete a personas cada vez más jóvenes a un riesgo notable de desarrollar un trastorno por causa del juego de azar (Luo y Ferguson, 2017).

En relación al tratamiento de los pacientes con TJA, nuestro trabajo incide en la importancia de evaluar de forma detallada las características psicológicas que presenta cada jugador. Los protocolos genéricos, que se han demostrado útiles para tratar al perfil de paciente tipo de las últimas décadas, pueden verse seriamente comprometidos por la aparición de nuevos tipos de jugadores. La frecuente aparición de pacientes cada vez más jóvenes, y con un perfil sociodemográfico distinto a lo que ha sido habitual, ha permitido, por ejemplo, identificar vulnerabilidades asociadas a aspectos de la impulsividad relacionados con la recompensa y el afecto positivo (urgencia positiva y búsqueda de sensaciones; ver también Barrault y Varescon, 2016; Goldstein, Vilhena-Churchill, Stewart, Hoaken, y Flett, 2016). Nuestros resultados sugieren que es más probable que los tratamientos predominantes en la actualidad no tengan éxito con estos

pacientes, y que el aumento del riesgo de fracaso es más fácilmente atribuible a las características psicológicas de los pacientes que a sus preferencias de juego per se. En otras palabras, se debe abordar la regulación emocional en sentido amplio como elemento esencial de las etapas iniciales del tratamiento (Jiménez-Murcia y cols., 2015).

Finalmente, se recomienda comprobar la eficacia de los tratamientos psicológicos empleados para el TJA, no sólo a nivel grupal, sino también individualmente. El éxito de las distintas vías en el tratamiento no debe evaluarse sólo por indicadores de tamaño de efecto habituales en los ensayos clínicos, sino que también debe evaluarse como éstos se ven modificados por la interacción entre la estrategia terapéutica y las características del paciente y de su entorno. El avance de los esfuerzos terapéuticos pasa por que esta adaptación no esté basada únicamente en la experiencia de cada equipo, sino en la evidencia acumulada. Tanto las técnicas psicológicas como su adaptación a perfiles específicos deben estar validadas científicamente.

CHAPTER 6

INTERNATIONAL DOCTORATE

Advancements in the study of the impulsivity and emotional regulation in gambling disorder: Studies with Spanish and Ecuadorian samples

In this chapter there are an extended summary, the general conclusions, clinical implications and final remarks.

6.1. Extended summary

Gambling disorder (GD) is characterized by a progressive dysregulation of gambling behavior, in which the individual presents uncontrollable and persistent desires to gamble despite its negative consequences (e.g., economic, family, or work problems attributable to gambling). GD is currently recognized as a mental disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM5; APA, 2013), and in the International Classification of Diseases (ICD-11; WHO, 2019). According to a systematic review, disordered gambling affects between 0.1 and 3.4% of the European population, and between 0.1 and 6% of populations of other countries in the World (Calado & Griffiths, 2016). However, it is presumed that prevalence rates are increasing, as globalization has generated new gambling modalities and access routes (e.g. through the Internet or mobile phone), and new modalities of payment or indebtedness. These new paths have also allowed people from certain populations, for whom the majority of in-site gambling modalities are illegal, to gamble, as offshore servers frequently elude regulation.

GD has a long research history. Many studies have reported the neurobiological and behavioral effects of GD to be similar to the ones of substance abuse disorders (Hodgins, Stea & Grant, 2011; Leeman & Potenza, 2012; Petry, 2010), although differences have also been described (Clark et al., 2018). Among the most thoroughly studied etiological factors, in relation to vulnerability and course of GD, we can find impulsivity, emotional dysregulation, and cognitive biases. These factors have been included in a number of theoretical models aimed at accounting for the development and maintenance of GD. For example, Blaszczynski & Nower (2002) proposed a model in which problem gambling is mainly caused by conditioning mechanisms (*behaviorally conditioned problem gamblers*), and two other subtypes of gamblers are defined by the concurrence of affect disturbances (*emotionally vulnerable problem gamblers*), or the presence of impulsivity traits and conduct problems (*antisocial impulsive problem gamblers*). Further evidence has supported this clustering, but, at the same time, has allowed to advance in the understanding of impulsivity and emotional regulation as a multifactor construct (Evenden, 1992; John & Gross, 2004; Whiteside & Lynam 2001), and has highlighted the importance of affect regulation in the origin of the relationship between impulsivity and individual differences among gamblers.

Affect-driven impulsivity, emotional regulation and the processes in which both constructs overlap, are therefore considered crucial factors to understand GD and individual variations among gamblers, with or without GD. Recently, this idea has been taken up by the *Gambling Space Model (GSM; Navas et al., 2019),* which represents the theoretical basis of this thesis. In general terms,

the GSM tries to integrate affect-driven impulsivity, emotional regulation strategies, cognitive biases and reinforcement components, as the main variables that explain the individual differences among gamblers. The model is defined by four dimensions: *(1) sensitivity to appetitive properties of gambling*, regarding reward-based motives of the individual to gamble, by virtue of both general sensitivity to reward, and the specific features of the gambling activity; (2) *negative reinforcement components of gambling*, whereby individuals are motivated to gamble in order to cope with negative affective states; (3) *generalized emotion dysregulation*, reflected in the tendency to behave impulsively under negative affective states; and (4) *self-deception* and *cognitive elaboration*, that refers to the tendency to use elaborated cognitive strategies to justify gambling and reduce its impact. As detailed in later sections, the first two dimensions include the use of overt emotion regulation strategies (enhancement and coping, respectively; see Stewart & Zack, 2008), the fourth dimension includes the use of covert but controlled (model-based) cognitive strategies, and the third one depends on implicit (model-free) mechanisms of emotion regulation.

In this framework, the general objective of this thesis is to advance in the understanding of the role of impulsivity and emotional regulation in GD, and the problems derived from it. This contribution is developed in three ways, that constitute the three central chapters of this thesis: a) to extend the validity and clinical relevance of the variables of interest to contexts beyond developed western countries, b) the use of such variables, not cross-sectionally, but longitudinally, to predict the results of psychological therapy for GD, and c) the experimental exploration, through behavioral decision-making tasks, of at least part of these variables, which should serve as an interface to connect the behavioral manifestations of gambling and its neurocognitive bases.

In Chapter 2, a cross-cultural study is presented to try to corroborate the relationships already known to exist between the constructs of interest (affect-driven impulsivity, emotional regulation and gambling-related cognitive biases) and behavioral and clinically-relevant manifestations of gambling in a Ecuadorian sample. These relationships have been previously reported in Spanish and English samples (see Del Prete et al., 2017; Michalczuk, Bowden-Jones, Verdejo-García & Clark, 2011) and are predicted by the GSM. Since the GSM is psychobiologically inspired, a conceptual replication of these relationships is expected. More specifically, a first hypothesis states that gambling-related cognitive biases are more closely related to aspects of emotional impulsivity than to their cognitive facets. A second hypothesis states that cognitive biases reflect a reinterpretation of gambling outocomes, or justifications of feelings and motives, and that these must be associated with the use of putatively adaptive emotion regulation strategies (i.e. reappraisal). According to a third hypothesis, it is predicted that signs of

model-free emotional dysregulation, measured as negative urgency, must be related to behavior dysregulation beyond gambling, in the form of affect and externalizing comorbidities.

In Chapter 3, we explore the role of impulsivity, and, more specifically, its emotion-driven dimensions, in the level therapeutic compliance and risk of treatment dropout in a sample of patients with GD. Most previous studies about this relationship have not clearly differentiated between dropout, relapse, and adherence to treatment. This chapter presents a study with a Spanish sample, in which the predictive value of impulsivity, as measured by the UPPS-P, was investigated, with regard to therapeutic compliance and dropout during a 6-month follow-up. In line with previous research, we expected to find an inverse relationship between adherence measures and variables that are related to positive reasons to gamble (sensation seeking), or the presence of emotional dysregulation (positive and negative urgency), as also derived from the dimensions *sensitivity to components of positive reinforcement* and *generalized emotional dysregulation* of the GSM. These two dimensions are hypothesised to influence adherence indices by directly affecting motivation to stop gambling, and by modulating gamblers' relationships with their social environment, respectively.

Chapter 4 describes a study conducted with a sample of Ecuadorian patients under treatment for substance abuse who also presented gambling problems, and healthy controls. This study was aimed to test whether the Affective Probabilistic Reversal Learning Task (PRLT) is sensitive to the neurocognitive factors that sustain affect-driven impulsivity and gambling severity. The PRLT is a *decision-making under ambiguity* task, in which learners have to dynamically adjust their choice preferences to reinforcement contingencies that initially unknown, and are programmed to change throughout the task. This task has been mainly used to measure learning flexibility, as required for adaptive dynamic decision making. Recent models of emotional regulation postulate that this sort of flexibility reflects the operation of unintentional mechanisms required to update the hedonic value of the choice options (Damasio, 1994; Etkin et al., 2015), and, therefore, the PRLT could capture the functioning of automatic or *model-free* emotion regulation (Braunstein, Gross, & Oschner, 2017). In relation to this, our fundamental hypothesis is that patients will show a reduced ability to adapt their decisions to changes in reinforcement contingencies, once initial preferences have been established, and that this pattern will be aggravated by the presence of signs of generalized emotional dysregulation, measured with the negative urgency scale of UPPS-P. Secondarily, the study is aimed at providing methodological improvements in the analysis of the PRLT, in order to avoid the multiplicity of analyses that are currently reported in the literature (van Timmeren, Daams, van Holst &

Goudriaan, 2017), and make PRLT results difficult to interpret. Here we analyze complete acquisition and reacquisition curves, in a trial-by-trial mannter, and estimate the sensitivity of those curves to the main manipulations of the task (sign of contingency and learning trial), as well as to the predictors of theoretical interest: group (patients versus controls), negative urgency (measured through the UPPS-P), and gambling severity (measured through the SOGS).

The results reported in this thesis allow substantial advances in the understanding of how affect-driven impulsivity and emotion regulation are involved in GD variability. In study 1, described in chapter 2, the relations between emotional impulsivity (measured by the UPPS-P), emotion regulation strategies (ERQ), cognitive biases (GRCS), gambling severity (SOGS) and the presence of comorbid problems related to alcohol and illegal substances abuse (MultiCAGE CAD-4) were found to closely fit GSM predictions. Associations were found between gambling severity and most impulsivity indices and cognitive distortions, as well as between gambling severity and problems derived alcohol and drugs abuse, which reinforces the relevance of all these variables in the characterization of gambling behavior. Moreover, from a theoretical point of view, the most relevant associations were (1) the one of negative urgency with the use of the suppression to regulate negative emotions, and (less consistently) with alcohol problems; (2) the ones of sensation seeking with the cognitive distortions measured by the GRCS, and –more specifically– of positive urgency with GRCS cognitive biases' submesures; and (3) the one of reappraisal with cognitive biases measured by the GRCS. This pattern of relations (see the network analysis for these data in supplementary materials) reveals the motivational-emotional nature of cognitive biases, and their link with emotion regulation strategies, as predicted by the GSM.

Results from the study 2, described in the chapter 3, show that emotional impulsivity bear predictive value with regard to the outcomes of the psychological treatment. On the one hand, positive urgency was shown to predict the risk of premature dropout, while lower scores in sensation seeking predicted higher levels of treatment compliance. In relation to this last result, awareness of gambling problems was also found to contribute to higher levels of compliance.

Results from the study 3, described in chapter 4, show that the Probabilistic Reversal Learning Task is probably sensitive to more than one process involved in disordered gambling. Both patients and healthy controls made better decisions as acquisition/reacquisition phases progressed. However, healthy controls reached higher learning levels (higher number of correct answers) by the end of each phase. More importantly, when analysing performance in the PRLT as a function of severity SOGS in the group of patients, more severe gambling was found to be associated with a higher level of learning inflexibility, this is, with lower efficiency in preference

reacquisition during the reversed contingency phases. A similar inflexibility increase was also observed to be linked to negative urgency. Additionally, these effects of negative urgency and the SOGS on PRLT performance were at least partially independent of each other. In other words, performance in the PRLT (understood as learning inflexibility) is seemingly related to incidental emotion regulation processes, although this does not fully account for its relationship with problematic gambling symptoms.

From a clinical perspective, these results highlight the importance of adjusting and complementing current treatment protocols in a personalized manner. First, metacognitive abilities training could be beneficial for patients who are prone to use emotion regulation strategies to justify their motives and desires to gamble (self-deceptive gamblers). Such treatment should be designed to make them aware of the connection between their irrational beliefs and their real motives to gamble. Second, mindfulness techniques integrated within cognitive-behavioral therapies could be effective at treating generalized emotion dysregulation, and seem to be particularly effective in patients presenting deficits in affective decision-making (Alfonso, Caracuel, Delgado-Pastor, & Verdejo-García, 2011). Third, the treatment of patients showing signs of learning inflexibility and other domain-independent cognitive alterations could be complemented with executive function training techniques. These techniques have been shown to be effective in patients with substance use disorders (Christiansen, Schoenmakers, & Field, 2015). And fourth, results point towards the importance of specifically addressing motivational ambivalence, especially in gamblers with features known to be associated with such ambivalence (e.g. positive motives, younger age), who also present an increased risk of dropout, and reduced treatment compliance.

In relation to the possible transcultural implications, results from studies 1 and 3 suggest that GSM constructs are consubstantial to individual variability among the gamblers, and, therefore, possibly generalizable across cultures. First, the pattern of correlations between the variables under study was similar to the one previously reported for Spanish and British samples. And second, as predicted from the model, Ecuadorian patients showed increased levels of learning inflexibility associated with higher levels of negative urgency, and more severe gambling symptoms. Nonetheless, this does not imply that gambling behavior always manifests in the same way across cultural contexts. Specifically, and although we do not have direct comparative data, the Ecuadorian sample of non-disordered gamblers (study 1) showed large correlations between gambling engagement and externalizing comorbidities (particularly alcohol abuse, see Table 2.2). which is also suggested by the fact that people with problematic gambling levels usually seek help

for substance abuse disorder (study 3). This fact could be explained, in part, by the social and legal characteristics of Ecuador, where gambling is has been illegal since 2011. There is evidence that illegal activities tend to attract more impulsive profiles, a concur with a higher risk of incurring in other illicit activities. (White, Tice, Loeber and Stouthamer-Loeber, 2002).

6.2. General conclusions

The main objective of this work has been to advance in our understanding of the implications of emotion-driven impulsivity and emotion regulation in the development, maintenance and pathologisation of gambling, aiming specifically at aspects not sufficiently covered by previous research. The identified gaps include: (1) the transcultural study of the implications of these constructs in gambling, (2) the exploration of these constructs as predictors of therapy dropout and therapeutic compliance, and (3) the use of laboratory tasks, and specifically of the PRLT, as sensitive instruments to tap on the neurocognitive mechanisms of gambling.

The studies included in this thesis (Chapters 2, 3, and 4) individually address each of these aims. Results from these three studies are summarised in Figure 6.1. In the first study it was found that the relations between emotional impulsivity (measured by the UPPS-P), emotion regulation strategies (ERQ), cognitive biases (GRCS), gambling severity (SOGS) and the presence of comorbid problems derived from the abuse of alcohol and other illegal substances (MutliCAGE CAD-4) closely match the ones predicted by the GSM. Associations were found between gambling severity and most impulsivity indicators and cognitive distortions, as well as with the problems derived from abuse of alcohol and other drugs, which shows the relevance of all these variables when characterising GD. Theoretically, the most relevant associations are the ones (1) between negative urgency and the use of suppression, and (less consistently) between negative urgency and alcohol abuse; (2) between sensation seeking and the whole set of cognitive distortions from the GRCS and, more specifically, between negative urgency and the three cognitive biases from the GRCS; and (3) between the use of reappraisal and the GRCS cognitive biases. This pattern of relationships reinforces the motivational-emotional nature of cognitive biases and their link with emotion regulation strategies, as predicted by the GSM.

The GSM is a psychobiologically-inspired model. The corroboration of the relationships between constructs postulated by the model in the Ecuadorian sample reinforces the idea that such constructs are consubstantial to generating individual variability among gamblers. However, this does not necessarily imply that gambling behavior will manifest in the same way across cultural

contexts. The specific typologies of gamblers (the specific concentration zones within the dimensional space proposed by the model) can vary in relation to other individual and environmental variables. First, the availability of opportunities to gamble can vary across contexts, generating different opportunities for its conditioning. Second, different cultural environments offer different sources of gambling-related reward and punishment, concerning the dimensions of the model related to the properties of gambling as positive or negative reinforcement. Third, the differential involvement of people with greater or lesser cognitive and educational resources might lead to a higher or lower vulnerability to cognitive biases, in an almost paradoxical way. And fourth, the prohibition to gamble might contribute to attract people with a profile inclined towards taking higher risks to incur into illegal activities, as it seems to occur with people addicted to illegal substances (White, Tice, Loeber & Stouthamer-Loeber, 2002). This last possibility is of special interest in the study of gambling in Ecuador, as gambling is currently illegal in this country (since 2011), and this restriction might attract a type of gambler with of more problematic profile.

In the second study, positive urgency was the only predictor of dropout from therapy, whereas negative urgency fell just beneath the decision threshold. A lower score in sensation seeking, a higher degree of dysphoria and a higher degree of awareness about the problem were shown as predictors of therapeutic compliance. In relation to this study, it is important to note that the model's predictions regarding the possible involvement of negative urgency in the risk of dropout and the degree of compliance with therapeutic activities was not corroborated. It is possible that people with higher negative urgency levels are less prone to seek treatment (Patkar, 2004), or that they seek treatment for comorbid problems (e.g., other addictive disorders). Results from study 1 point towards this direction and highlight the importance of doing more specific studies directed to corroborate the possible relation between generalized emotion dysregulation and motivation to seek treatment.

Results from the study are compatible with the idea that gamblers who are currently under treatment may remain, for a long period of time, ambivalent in relation to their decision of continuing in treatment (and therefore, quit gambling indefinitely). Sztainert et al., (2014) have highlighted the importance of positive reinforcement in relation to rejecting treatment. Our data reveal that the dimensions of impulsivity related to appetitive processes (positive urgency and sensation seeking) predict a higher dropout risk and a lower level of compliance (see also Aragay et al., 2015; Jiménez-Murcia et al., 2012), and that this tendency can be countered, in part, by a higher awareness of problems related to gambling. Therefore, our data point towards the importance of working on this ambivalence, particularly in persons who hold appetitive motives

to keep on gambling. Such contribution is of great relevance and allows to take into account the characteristics that patients should develop or strengthen for their rehabilitation.

In the third study, carried out with an Ecuadorian sample, it could be observed that, in the execution of the PRLT, both patients and healthy controls' correct answers increased across trials within each phase. However, the healthy control group achieved higher learning levels (higher number of correct answers) by the end of each phase. On the other hand, when analysing the performance of the PRLT in relation to the SOGS, it was found that higher severity of gambling was associated with a higher level of learning inflexibility, namely, a lower efficacy in the reacquisition of preferences during the reversed contingency phases of the task. Similarly, an increase of inflexibility associated with negative urgency was also observed. Finally, results show that the effects of negative urgency and SOGS severity and PRLT performance are at least partially independent.

These results suggest, on the one hand, that gambling severity is associated with learning inflexibility, which has also been reported for cocaine-dependent individuals (Moreno-López y cols., 2015). Seemingly, addiction chronicity has a generalized detrimental effect on feedback-based decision-making. On the other hand, the relationship between negative urgency and PRLT inflexibility seems to show that patients with emotion regulation difficulties could have difficulties to extinguish acquired preferences and update them on the basis of new contingencies, as proposed by Braunstein y cols. (2017). These results, considered along the ones from study 1, suggest a high prevalence in Ecuador of a subtype of gambler with high impulsivity levels, with a higher risk of antisocial behaviors, and poor prognosis. As mentioned earlier, it is possible that gambling features related to its legal status make it more attractive for impulsive people with lower flexibility in affect-based learning tasks.

Relatedly, this study has advanced in two other directions. First, it provides a methodology for the study of PRLT performance not based on partial indicators (number of correct/incorrect responses, or perseverative errors), but in which full acquisition/reacquisition functions are experimentally modelled. The second contribution regards Navas et al.'s (2019) hypothesis that the PRLT task and negative urgency could partially rely on similar model-free emotion regulation processes, and could be thus used to assess processes that have been difficult to measure to date, due to its automaticity and low level of awareness.

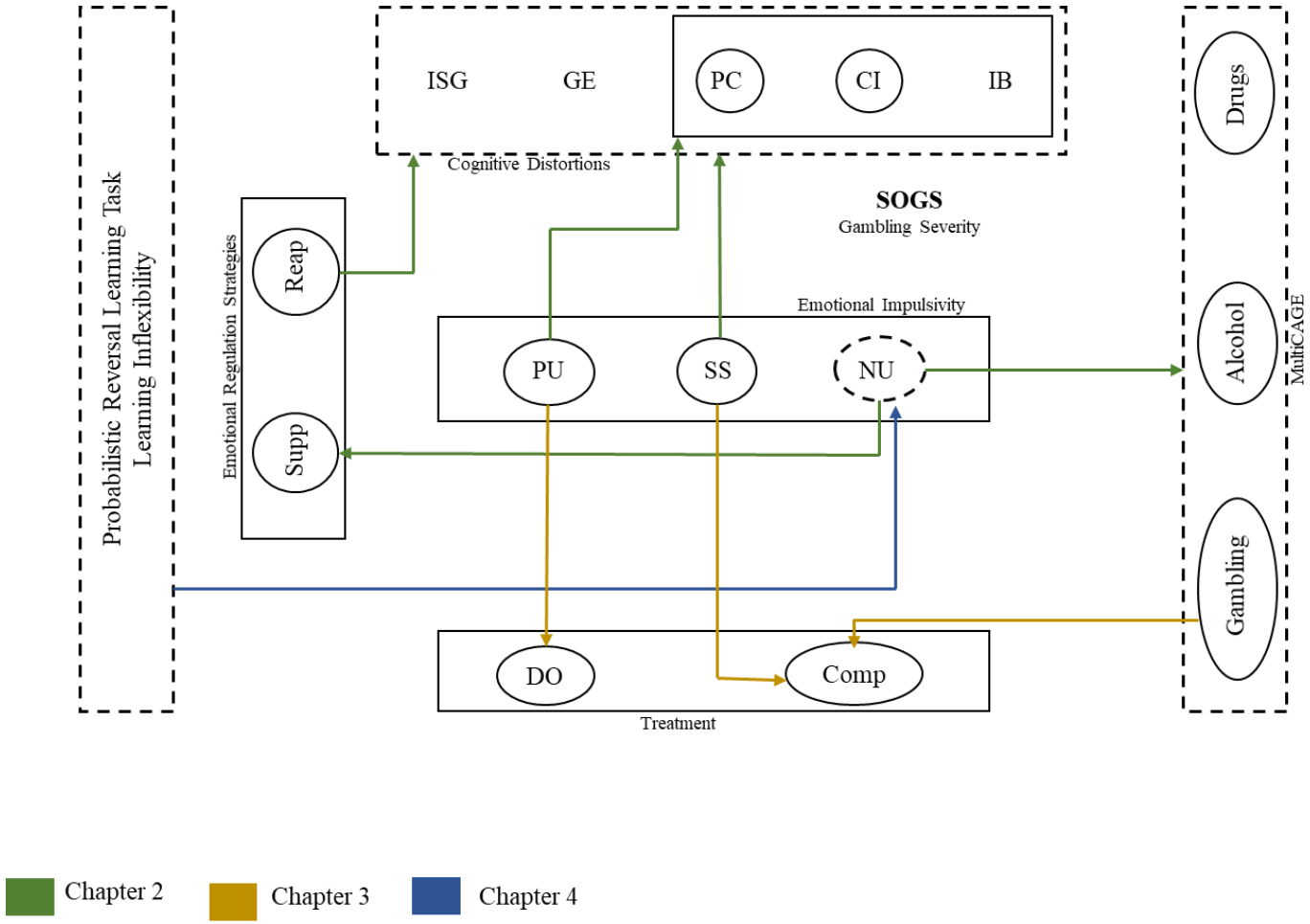

Figure 6.1. Summary of the main findings of the 3 studies. Note: Dotted lines identify variables from the studies that have been associated with gambling severity (SOGS). Abbreviations: ISG, GE, PC, CI and IB (GRCS; inability to stop, gambling expectancy gambling, predictive control, control illusion, interpretive biases), PU, NU, SS (UPPS-P; positive urgency, negative urgency, sensation seeking), DO y Comp (dropout and compliance), Supp and Reap (ERQ; suppression and reappraisal).

6.3. Clinical implications

Results from study 1 corroborate previous findings regarding the importance of taking into consideration individual differences to address GD treatment. More specifically, according to predictions made by the GSM (see Table 1 in Navas et al., 2019), an association was found between negative urgency and the risk of comorbidities related to substance abuse, and with a more frequent use of suppression (which is also associated with a higher risk of psychopathology). In other words, the sub-group of gamblers with clearer signs generalized emotion dysregulation (to some extent, similar to impulsive-antisocial gamblers in the *Pathways Model*; see Figure 1.1) would present higher levels of over-pathologisation and gambling complications.

Some previous works (Knezevic-Budisin, Pedden, White, Miller & Hoaken, 2015; Maccallum, Blaszczynski, Ladouceur & Nower, 2007) outline the specific difficulties presented in the treatment of this type of patients, in which the lower availability of basic emotion-regulation mechanisms leads to an overload of executive capabilities in situations of high emotional impact, making the use of deliberate strategies more cognitively taxing (Navas et al., 2017a). In these cases, mindfulness techniques integrated into cognitive-behavioral therapy have demonstrated efficacy in the treatment of addiction with comorbid emotion dysregulation (Hoppes, 2006), as well as in patients presenting poor performance in decision-making tasks related to emotion regulation (Alfonso, Caracuel, Delgado-Pastor, & Verdejo-García, 2011).

The observed association between reappraisal (an emotion regulation strategy commonly considered adaptive and frequently included in cognitive-behavioral packages) and a more intense cognitive symptomatology (higher cognitive biases) also have important implications. Possibly, people using these mechanisms for ego-protection are particularly resistant to cognitive re-structuration. In relation to this, a possible alternative would be training them on metacognitive abilities, designed to make patients more aware of the connection between their dysfunctional beliefs and their motives to gamble (see Lindberg, Fernie & Spada, 2011).

Among the cultural specificities of the Ecuadorian sample, with regard to the clinical manifestations of the model dimensions, we have found some difficulty to corroborate the relationship between negative urgency and comorbidities in the drug abuse domain. This difficulty can be partially accounted for by some differential features of gambling in Ecuador. Gamblers with GD in Ecuador frequently use virtual casinos hosted in servers outside the country (see Gainsbury et al., 2013 for a review about how internet gambling may contribute to the development of problems related to gambling and its pathologization), or cross the border to

neighbour countries, taking higher risks and investing more resources to gamble. This type of gambler tends to seek help in rehabilitation clinics for alcohol and drugs related problems, as in Ecuador there are no specialised rehabilitation centres for treating GD[4], and they are rarely aware of their gambling problems. Relatedly, Ecuadorian gamblers, even without GD, present a higher probability to incur in other risky behaviors. In other words, gambling prohibition seems to attract a more problematic personality profile, which could have reduced in our sample the variability range in the construct of generalized dysregulation, making the verification of strong correlations more difficult.

The second study shows that people who are more sensitive to appetitive motives and stimuli (characterised by higher scores in positive urgency and sensation seeking) are more prone to drop out from treatment or to not adequately follow it. This result highlights the importance of assessing appetitive motives for gambling and problem awareness as dropout/noncompliance risk indices, and the need to address motivational ambivalence as an essential part of the first phases of therapy. The fact that motivational ambivalence is particularly intense in people with higher scores in variables related to appetitive aspects of gambling indicates, on one side, that these characteristics could be especially relevant in some subgroups of gamblers. As it has been previously described (see also Navas et al., 2017b), appetitive motives are especially prevalent in young gamblers with preference for skill-based games, casino, cards and bets (type I), and in online gamblers (see Jiménez-Murcia et al., 2019). There are specific intervention technics, such as motivational interviewing, which allow to adress ambivalence towards treatment (Arkowitz, Miller & Rollnick, 2015; Rollnick & Miller, 1995). We propose these techniques to be used as an early preventive tool for potentially problematic gambling in young population and educational settings, as a complement to the type of gambling psychoeducation usually delivered in these cases.

Lastly, results from study 3 concern the need to improve general cognitive functions in some individuals with addictive disorders. Our data suggest a higher incidence of alterations in cognitive functions related to learning flexibility among addicted patients with gambling problems compared to controls, with other studies showing that these alterations are not that prevalent in other patients with addictive disorders. This means that correct assessment of these alterations

[4] As soon as most gambling activities were prohibited in Ecuador, clinics and support groups also disappeared (which was unexpected, as treatment facilities and services were never banned). This made gambling problems mostly invisible to the public.

may help to identify patients for whom neuropsychological intervention could be beneficial. Some recent studies have explored how these types of interventions could be extended to treatment of addictive disorder. For example, several online and smartphone-based cognitive training programmes have been designed for patients with alcoholism. One of these training programmes (the neuropsychological programme mHealth) was aimed to tackle working memory, attention, and logical reasoning, and revealed a significant reduction of executive dysfunctions (Bell, Vissicchio & Weinstein, 2016). In general, neuropsychological training programmes have also shown evidence of increased neuroplasticity during the abstinence phase (Manning, Verdejo-Garcia & Lubman, 2017). The retraining of cognitive biases has also shown efficacy in people with addictive disorders (Christiansen, Schoenmakers & Field, 2015).

6.4. Final remarks

In this thesis, we have argued that the generality of neurobiological properties of GD does not imply that it will manifest homogeneously across contexts. Indeed, addressing gambling in a culturally inclusive manner remains indispensable. This necessity, however, contrasts with the tendency of many research groups and funding agencies to neglect or disregard the importance of sociocultural factors in their efforts. This tendency is in part responsible for the absence of more precise prevalence estimates of gambling problems worldwide, as well as for their insufficient visibility in many countries. Developing these research lines would allow to implement psychoeducative interventions to prevent gambling pathologisation, and would facilitate the access of patients with GD in these countries to the kind of treatment they need.

On the other hand, cross-cultural data could inspire the development and implementation of better policies in both developing countries, and in countries where prevention and treatment strategies are already in place. Here, we have discussed the possible negative consequences of prohibiting gambling, and how these can negatively interact with individual vulnerabilities. Nevertheless, cross-cultural comparisons can also reveal the consequences of insufficient regulation in developed countries. Studies like the one presented by Navas et al. (2017b) suggest that the amount of gambling exposure, via marketing and ubiquitous availability, interacts with the psychological mechanisms of emotion regulation, negatively affecting patients' recovery, and exposes young people to a significant risk of developing a disorder due to gambling (Luo & Ferguson, 2017).

In relation to the treatment of patients with GD, our work suggests the importance of evaluating in detail the psychological characteristics that each gambler presents. Generic protocols that have been shown to be useful in treating the type of patient that have been more prevalent in the last decades, can be seriously compromised by the emergence of new gambler profiles. The increasingly frequent diagnosis of gambling disorder in younger patients, with markedly different sociodemographic features, has allowed to identify, for example, vulnerabilities associated with aspects of impulsivity in the domain of reward and positive affect (positive urgency and sensation seeking, see also Barrault & Varescon, 2016; Goldstein, Vilhena-Churchill, Stewart, Hoaken & Flett, 2016). Our studies suggest that currently predominant treatments are more likely to be unsuccessful with these patients, and that the increased risk of failure is more easily attributable to patients' psychological characteristics than to their gamble preferences per se. In other words, emotional regulation in a broad sense must be addressed as an essential element of the initial stages of treatment (Jiménez-Murcia et al., 2015).

Finally, it is recommended to test the efficacy of the psychological treatments employed on patients with gambling disorder, not only at the group level, but also individually. The success of the different treatment strategies should not be evaluated only by the effect size indicators that are common in clinical trials. Beyond them, we need to specify how treatment outcomes are modulated by characteristics of the patient and her/his environment. Individualization efforts must not rely on the experience of each team or therapist, but on cumulated evidence. Both psychotherapeutic techniques and their adaptation to specific profiles must be scientifically validated.

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MATERIAL SUPLEMENTARIO

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SUPPLEMENTARY MATERIAL

S1. Bayesian network analysis

In order to provide a data-driven depiction of the associations in the correlation matrix shown in Table 2.2 (main text), we performed a network analysis, as implemented in JASP software. Figure S1.1 shows the network plot of non-zero edges (41/105), estimated with the graphical lasso (Friedman, Hastie, & Tibshirani, 2008). The tuning parameter was chosen using the Extended Bayesian Information criterion (EBIC) described by Foygel & Drton (2010). The process was bootstrapped 100 times, using non-parametric bootstrapping. The corresponding weights matrix is displayed in Table S1.1. The JASP file containing these analyses is available without restriction at http://osf.io/zy9k8.

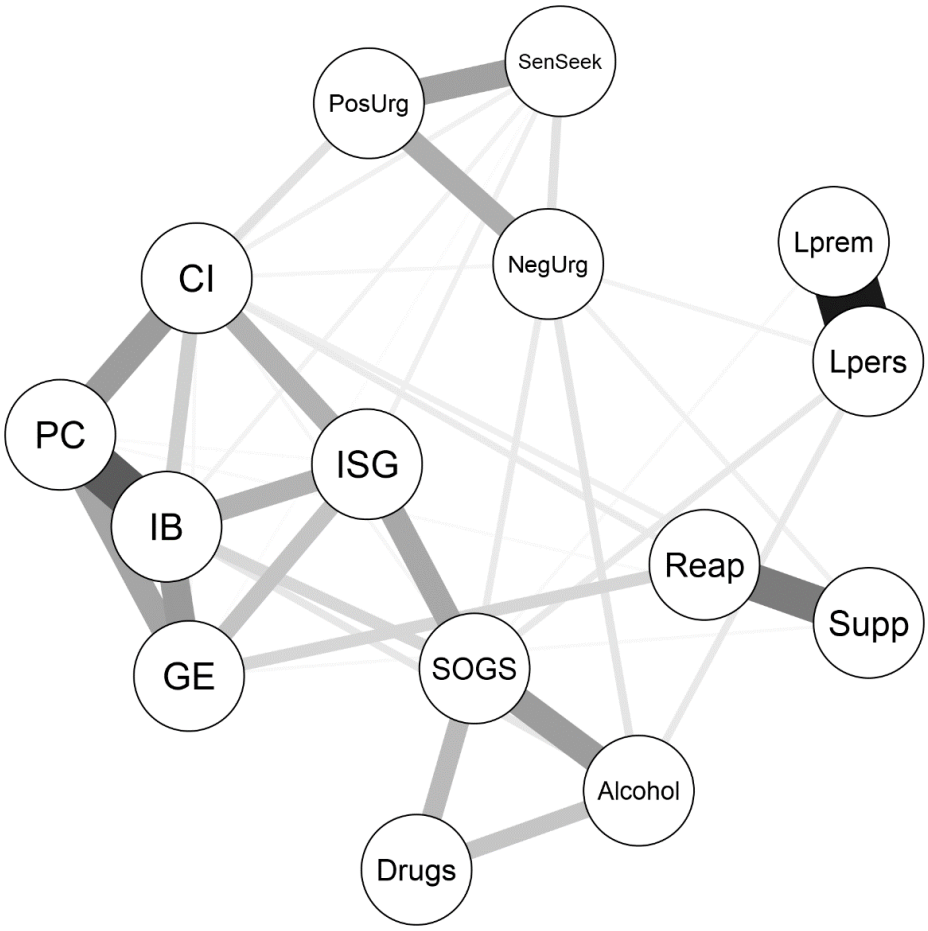

Figure S1.1.Network plot of non-zero edges for main variables in the model (EBIC graphical lasso). Abbreviations: Drugs and Alcohol (MultiCAGE drugs and alcohol misuse subscales), SOGS (gambling severity), ISG, CI, IB, PC, and GE (GRCS inability to stop gambling, control illusion, interpretative bias, predictive control and gambling expectancies), PosUrg, NegUrg, SenSeek, LPrem, Lpers (UPPS-P positive urgency, negative urgency, sensation seeking, lack of premeditation and lack of perseverance), Supp and Reap (ERQ suppression and reappraisal).

In accordance with main LME analysis, beyond associations within questionnaires, the network retained links of positive urgency with control illusion, of sensation seeking with control illusion and inability to stop gambling and interpretative bias, of suppression with negative urgency, of reappraisal with gambling expectancies and control illusion, and of negative urgency with SOGS severity and alcohol misuse. The remaining non-zero associations were not explicitly predicted. Interestingly, UPPS-P lack of premeditation and lack of perseverance were mostly disconnected from the other impulsivity dimensions (except for a weak link between negative urgency and lack of perseverance), and also from gambling cognitions.

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Table S1.1. Weights matrix for the network analysis, as shown in Figure S1.1

	Alcohol	*Drugs*	*CI*	*GE*	*IB*	*ISG*	*PC*	*Lpers*	*Lprem*	*NegUrg*	*PosUrg*	*SenSeek*	*Reap*	*Supp*	*SOGS*
Alcohol	0.00	0.15	0.00	0.00	0.06	0.00	0.00	0.06	0.00	0.07	0.00	0.00	0.00	0.00	0.26
Drugs	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
CI	0.00	0.00	0.00	0.02	0.13	0.20	0.26	0.00	0.00	0.02	0.07	0.04	0.05	0.04	0.02
GE	0.00	0.00	0.02	0.00	0.27	0.16	0.24	0.00	0.00	0.00	0.00	0.01	0.11	0.01	0.00
IB	0.06	0.00	0.13	0.27	0.00	0.20	0.44	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.11
ISG	0.00	0.00	0.20	0.16	0.20	0.00	0.01	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.23
PC	0.00	0.00	0.26	0.24	0.44	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00
Lpers	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.03	0.00	0.00	0.00	0.00	0.06
LPrem	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.01
NegUrg	0.07	0.00	0.02	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.22	0.07	0.00	0.04	0.05
PosUrg	0.00	0.00	0.07	0.00	0.00	0.00	0.02	0.00	0.00	0.22	0.00	0.25	0.00	0.00	0.00
SenSeek	0.00	0.00	0.04	0.01	0.03	0.04	0.00	0.00	0.00	0.07	0.25	0.00	0.00	0.00	0.00
Reap	0.00	0.00	0.05	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00
Supp	0.00	0.00	0.04	0.01	0.00	0.00	0.01	0.00	0.00	0.04	0.00	0.00	0.35	0.00	0.00

Abbreviations: Drugs and Alcohol (MultiCAGE drugs and alcohol misuse subscales), SOGS (gambling severity), ISG, CI, IB, PC, and GE (GRCS inability to stop gambling, control illusion, interpretative bias, predictive control and gambling expectancies), PosUrg, NegUrg, SenSeek, LPrem, Lpers (UPPS-P positive urgency, negative urgency, sensation seeking, lack of premeditation and lack of perseverance), Supp and Reap (ERQ suppression and reappraisal).

S2. Treatment Characteristics

All participants followed the same treatment protocol, with the same therapist, and in the same facilities (AGRAJER). This treatment is similar to the one offered by other associations that make up the Regional Federation *Federación Andaluza de Asociaciones de Jugadores de Azar en Rehabilitación* (*FAJER*). The mean duration of the complete treatment program is approximately two years. The specific techniques used in the program are based on the cognitive- behavioral model.

The treatment protocol comprises 4 phases. In the first (1 session, *Pre-welcome*) the prospective patient has his/her first contact with the institution and a welcome session is scheduled. In the second phase (1 session, *Welcome*), two co-therapists (a rehabilitated gambler and a relative) welcome and encourage the patient to accept treatment. Sessions in the third phase (*self-help* and *mutual help*) are group-based, and comprise preliminary, start, and actual rehabilitation stages. Sessions in this stage are programmed on a weekly basis, hosted by rehabilitated gamblers and supervised by a professional therapist. Partially in parallel, a fourth stage (*individual psychotherapy*), is held by the AGRAJER clinical psychologist. Individual intervention has a psychoeducational theme, and is designed to assess the evolution of the patient in therapy in order to allow him/ her to become more aware of the addictive process and its symptoms, to teach strategies to prevent relapse, to examine cognitive distortions in gambling, to strengthen self-esteem, social abilities, and assertiveness, to train him/her in anger management, self-control and problem-solving, and to promote rewarding activities. It generally takes one year for the patients to advance through these three stages, in dependence of goals fulfillment.

After this stage, abstinent patients who had not abandoned the group are discharged and start a final, follow-up stage. Patients in this stage meet once a month for an hour and a half. Patients can attend these meetings as long as they like to, as their objective is reinforcing abstinence and providing tools to manage risky situations that could lead to relapse.

In the present study, recruitment and the first assessment were carried out while patients were in the welcome phase or during the initial part of the self-help and mutual-help phase.

S3. RAW PRLT PERFORMANCE

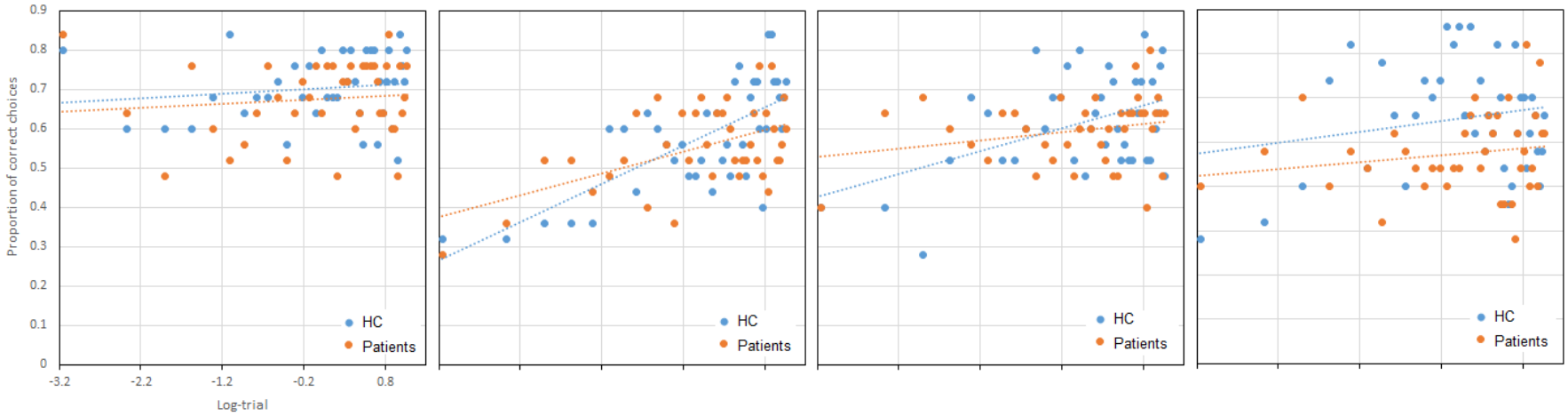

Figure S3.1. Displays the proportion of correct choices as a function of the zero-centered log-transformation of trial number across Phases (1-4) and Groups (HC, Patients). In all phases, the relationship between Log-trial and the proportion of correct choices was nearly linear. Additionally, a visual comparison of this figure with Figure 4.1 in the main manuscript show a very good matching between predicted and observed Log-trial effects.

CURRICULUM VITAE

Ma. Fernanda Jara Rizzo nació en Riobamba (Chimborazo), Ecuador el 23 de abril de 1988. Cursó sus estudios de Psicología en la Universidad de Guayaquil, Ecuador desde el 2007 hasta el 2012, año en el que obtuvo su título de Psicóloga Clínica. Por un año trabajó en Guayaquil como psicóloga clínica en un centro educativo, en la clínica privada, y en un proyecto de investigación sobre el desarrollo neuropsicológico infantil. En el 2013 se trasladó a España donde realizó un máster en Neurociencias cognitivas y del comportamiento en la Universidad de Granada, donde tuvo la oportunidad de empezar a trabajar en un estudio neurocognitivo y comportamental en el trastorno por juego de azar. Durante su periodo en la maestría obtuvo un premio a la mejor investigación presentada en el XI Congreso de la Sociedad Andaluza de Neuropsicología. Al terminar la maestría regreso a su país de origen en el que participó en un concurso de méritos y oposición para obtener una titularidad como docente de la Universidad de Guayaquil, del que se hizo acreedora en el 2015. En ese mismo año dicha Universidad también le otorgó una Beca para su Formación Doctoral en la Universidad de Granada. Durante sus estudios de doctorado ha participado en algunos eventos y congresos internacionales y nacionales. También realizó una estancia de investigación durante 6 meses en el *Attention and Memory Lab* de la *University College Dublin (UCD), Irlanda*. En la actualidad sigue manteniendo vinculación con la UCD. Es miembro de la Sociedad para el estudio de los juicios y las decisiones con sede en Granada, y miembro estudiante de la *Psychonomic Society* con sede en Estados Unidos.

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