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**Decision making
under risky and uncertain conditions
in typical and pathological adult samples**

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Index

Abbreviations	
Introduction	
Chapter 1	
1.1. Decision making under uncertainty and risk	
1.1.1. Decision making and executive functions	
1.1.2. Decision making in adulthood	
1.1.3. The assessment of decision making	
1.2. Aims	
1.3. Methods	
1.3.1. Stage 1: Identifying the research question	
1.3.2. Stage 2: Identifying relevant studies	
1.3.3. Stage 3: Study selection	
1.3.4. Stage 4: Charting the data	
1.3.5. Stage 5: Collating, summarizing, and reporting the results	
1.4. Results	
1.4.1. The relationship between the Iowa Gambling Task and cold executive functions....	
1.4.2. The relationship between the Game of Dice Task and cold executive functions	
1.5. Discussion	
1.5.1. Summary of evidence.....	
1.5.2. Limitations	
1.5.3. Conclusions.....	
1.5.4. Further directions	
Chapter 2	
2.1. Parkinson's disease: A brief clinical overview	
2.1.1 Principal motor symptoms	
2.1.2. Non-motor symptoms	
2.2. Why it is important to delve into decision making in patients affected by Parkinson's disease	
.....	
2.2.1. Decision making and cold executive functions.....	
2.3. Aims	
2.4. Methods.....	
2.4.1. Stage 1: Identifying the research question	
2.4.2. Stage 2: Identifying relevant studies	
2.4.3. Stage 3: Study selection	

2.4.4. Stage 4: Charting the data	
2.4.5. Stage 5: Collating, summarizing, and reporting the results	
2.5. Results	
2.5.1. Decision making performance in the Iowa Gambling Task	
2.5.2. The relationship between the Iowa Gambling Task and cold executive functions....	
2.5.3. Decision making performance in the Game of Dice Task	
2.5.4. The relationship between the Game of Dice Task and cold executive functions	
2.6. Discussion	
2.6.1. Summary of evidence.....	
2.6.2. Limitations	
2.6.3. Conclusions.....	
2.6.4. Further directions	
Chapter 3	
3.1. Introduction	
3.2. Aims	
3.3. Materials and methods	
3.3.1. Participants.....	
3.3.2. Procedure	
3.3.3. Materials.....	
3.3.4. Statistical plan	
3.4. Results	
3.4.1. Reliability of self-report scales	
3.4.2. Decision making under uncertainty: investigating the Iowa Gambling Task.....	
3.4.3. Decision making under risk: investigating the Game of Dice Task	
3.4.4. The behavioral propensity towards risk and uncertainty: Investigating the Balloon Analogue Risk-Taking Task	
3.4.5. The weight of the entity and the probability of occurrence in the decisional process: investigating the Drawn Lots Task	
3.4.6. Correlations among the decision-making tasks	
3.5. Discussion	
3.5.1. A comprehensive analysis of the Iowa Gambling Task performance in older adults	
3.5.2. What the Game of Dice Task performance can tell us about older adults' decision making under risk.....	
3.5.3. Some general reflections on decision making through the lens of the Balloon Analogue Risk-Taking Task.....	
3.5.4. Investigating the impact of information available to make a decision through the Drawn Lots Task.....	
3.5.5. Limitations	
3.6. Conclusions.....	

3.6.1. Implications.....	.....
Chapter 4.....	.....
4.1. Introduction.....	.....
4.2. Aims.....	.....
4.3. Materials and methods.....	.....
4.3.1. Participants.....	.....
4.3.2. Procedure.....	.....
4.3.3. Materials.....	.....
4.3.4. Analytic plan.....	.....
4.4. Results.....	.....
4.4.1. Comparing PD patients and HCs.....	.....
4.4.2. A focus on PD patients.....	.....
4.5. Discussion.....	.....
4.5.1. Differences in decision making between PD patients and HCs.....	.....
4.5.2. A focus on PD patients.....	.....
4.5.3. Limitations.....	.....
4.6. Conclusions.....	.....
4.6.1. Clinical implications.....	.....
General conclusions.....	.....
Acknowledgements.....	.....
References.....	.....
Sitography.....	.....

Abbreviations

ACC: anterior cingulate cortex
BART: Balloon Analogue Risk-Taking Task
BG: basal ganglia
BPs: bad performers
CFC: Consideration of Future Consequences-14 Scale
COMTI: Catechol O-methyltransferase inhibitors
CR: cognitive reserve
CRIq: Cognitive Reserve Index questionnaire
DA: dopamine agonists
dACC: dorsal anterior cingulate cortex
DASS: Depression Anxiety Stress Scale
DBS: deep brain stimulation
DII: Dickman Impulsivity Inventory
dlPFC: dorsolateral prefrontal cortex
DLT: Drawn Lots Task
DM: decision making
DOSPERT: Domain-Specific Risk-Taking
EDRs: electrodermal responses
EFs: executive functions
GDT: Game of Dice Task
GPs: good performers
HC: healthy control
ICDs: impulse control disorders
IGT: Iowa Gambling Task
LBs: Lewy bodies
LCB: Locus of Control of Behavior
LEDD: levodopa-equivalent daily dose
LOT-R: Life Orientation Test- Revised
IPFC: lateral prefrontal cortex
MAO-BI: monoamine oxidase-B inhibitors

MCQ-30: Metacognitions Questionnaire (CC: cognitive confidence; CSC: cognitive self-consciousness; POS: positive beliefs about worry; NEG: negative beliefs about uncontrollability and danger; NC: need to control thoughts)

MCST: Modified Card Sorting Test

MMSE: MiniMental State Examination

mPFC: medial prefrontal cortex

MRI: magnetic resonance imaging

NIRS: near-infrared spectroscopy

OAs: older adults

OFC: orbitofrontal cortex

PD: Parkinson's disease

PFC: prefrontal cortex

PRISMA: Preferred reporting of items for systematic reviews and meta-analyses

QUIP-RS: Impulsive-Compulsive Disorders in Parkinson's Disease – Rating Scale

RME: Reading the Mind in the Eyes Test

RPs: risky performers

SCRs: skin conductance responses

SPs: safe performers

TAS-20: Toronto Alexithymia Scale (F1 subscale: difficulty in identifying feelings; F2 subscale: difficulty in describing feelings; F3 subscale: cognitive style externally oriented)

TMT: Trail Making Test

ToM: Theory of Mind

UPDRS: Unified Parkinson's Disease Rating Scale

vIPFC: ventrolateral prefrontal cortex

vmPFC: ventromedial prefrontal cortex

vPFC: ventral prefrontal cortex

WCST: Wisconsin Card Sorting Test

YAs: younger adults

Introduction

Decision making (DM) has been receiving increased attention throughout the last decades, due to its pervasiveness in everyday life and its support for individual wellbeing and autonomy (Mather, 2006; Salthouse, 2012; Iannello et al., 2017). Considering the current historical period, people are called to face uncertain and risky decisions in manifold fields, such as the economic and medical ones. Gaining a deeper understanding of the neurocognitive mechanisms underlying DM under these particular conditions – namely, under uncertainty and risk – is crucial, especially considering the complex nature of the decisional processes, which encompass several cognitive and affective abilities (Schiebener & Brand, 2015).

In the present dissertation a particular focus was kept on the relationships between decisional performances and cognition, in particular on executive functions (EFs), which are pivotal abilities in most goal-directed behaviors and also in DM. As well, we explored possible individual traits affecting decisional processes.

We considered two specific targets that literature highlighted as at risk of developing decisional impairments leading to risky decisions: healthy older adults (OAs) and patients affected by Parkinson's disease (PD) (e.g., Denburg & Hedgcock, 2015; Colautti et al., 2021; Cool et al., 2022; Iannello & Colautti, 2022). As life expectancy is increasing and the global population over 65 years is growing faster than any other age group, it appears crucial to promote active aging (Chai et al., 2022); In this way, cognitive functioning, among which DM, covers a central role in preserving autonomy (Oschwald et al., 2019). Moreover, it appears essential to better understand the mechanisms underlying the cognitive elaboration of positive and negative consequences of a choice under conditions of uncertainty and risk, and the processes that lead the selection of a choice option over another. Dopamine is assumed to play an important role in such processes and PD – which is the second most common neurodegenerative disorder usually occurring around 60 years (Chen et al., 2022) – deserves attention. It allows both to delve into the neurocognitive DM mechanisms and to promote PD patients' wellbeing.

Thus, findings in such a field can support both (i) the prevention of possible negative results derived from poor choices and (ii) the cognitive enhancement and rehabilitation of these capacities by avoiding situations of fragility, which can be critical during the lifespan, and especially during aging, when consequences derived from bad decisions become more blatant and impacting the quality of life (Finucane and Lees, 2005; Denburg et al., 2007).

Chapter 1 presents a scoping review that aimed at providing a comprehensive overview of the relationships between DM under uncertainty and risk and cold EFs in healthy adults during the lifespan – with a focus on OAs – highlighting the main results from literature and identifying possible gaps. Similarly, Chapter 2 reports a scoping review aimed to delve into DM under uncertainty and risk and the relationships with cold EFs in patients affected by PD, as evidence highlighted the tendency toward risky choices in this disorder. In this Chapter, the neural mechanisms involved in DM are thoroughly analyzed, as PD affects most of the neural structures pivotal in decisional processes under uncertainty and risk. Basing on the main findings from Chapter 1 and the identified gaps to date present in literature, Chapter 3 reports a research study that investigated DM processes in a sample composed of healthy older adults, highlighting how cold EFs can support DM under uncertainty and risk during aging. As well, basing on results and suggestions of possible knowledge gaps present in the literature as stressed in Chapter 2, Chapter 4 concerns an in-depth research study aimed at deepening the cognitive and neural mechanisms implied in PD patients' decisional process. Possible relationships of DM performances with cold EFs, individual traits, and dopaminergic medications were discussed, to shed light on possible factors which can lead patients to suboptimal and risky choices. In both Chapters 3 and 4 practical implications derived from findings were considered, and future research directions were suggested.