What Does a Jigsaw Puzzle Tell About How Cognitive "Mechanisms" Process the World in General and Language in Particular?
A Cognitive Linguistics Study

Houda Baouissidi, Darkaoui Soufi Habib

Laboratory of Translation, Intercultural Communication and Knowledge Integration,
Faculty of Arts and Humanities, Cadi Ayyad University, Marrakech, Morocco.
Email: h.baoussidi.ced@uca.ac.ma

Abstract

This study examines the relationship between language processing in cognitive processes and jigsaw puzzle solving techniques. The study examines the connection between both domains to learn more about the connections between language processing mechanisms and puzzle-solving techniques. The study, which makes use of a broad subject pool, combines sophisticated neuroimaging methods like eye tracking and functional magnetic resonance imaging (fMRI) with conventional puzzle-solving tasks. By doing this investigation, the research hopes to learn more about the ways in which language processing mechanisms are impacted by or intersected with puzzle-solving techniques, which will further our knowledge of cognitive processes.

Keywords: Jigsaw puzzles, cognitive mechanisms, language processing, spatial reasoning, cognitive overlap.

1. Introduction

Understanding the complexities of cognitive mechanisms underpinning human perception and language processing stands as a pivotal pursuit in cognitive science. In this context, the analogy drawn between cognitive processes and the act of assembling a jigsaw puzzle serves as an intriguing avenue to delve into the intricate workings of cognition.

Cognitive science delves into the nuanced interplay of various mental processes governing perception, learning, memory, and language comprehension. These cognitive functions intricately weave together to construct our understanding of the world around us and how we interpret linguistic information.

The essence of a jigsaw puzzle lies in its representation of piecing together fragmented information to create a coherent whole (Smith, 2000). Similarly, our minds undertake a parallel exercise, synthesizing an array of sensory inputs and linguistic cues to derive meaning and comprehension (Smith, 2000). This analogy offers a unique vantage point to explore the

cognitive processes at play during language processing. At the core of this comparison lies the concept of pattern recognition. Just as assembling a puzzle demands identifying patterns and connections between individual pieces, language comprehension involves discerning linguistic structures and nuances within words and phrases to extract overarching meaning.

Moreover, the iterative nature of solving a puzzle mirrors the adaptability and flexibility inherent in cognitive mechanisms. Our minds, much like rearranging puzzle pieces, continuously adjust and reassess information to form coherent understandings (Smith, 2000). Similarly, language comprehension involves a continuous process of reevaluation and adaptation based on contextual cues, syntax, and semantics to derive accurate interpretations.

This analogy further resonates with the concepts of top-down and bottom-up processing in cognition. Top-down processes, guided by prior knowledge and expectations, shape initial approaches to solving puzzles, much like preconceived notions influence our approach to understanding language. Conversely, bottom-up processing involves scrutinizing individual puzzle pieces or linguistic elements devoid of preconceived templates.

Furthermore, the role of attention and working memory emerges prominently in both puzzle-solving and language comprehension. Assembling a puzzle demands focused attention and the management of multiple pieces of information simultaneously—analogous to the attentional and memory processes inherent in language interpretation.

This academic exploration aims to unveil the parallels between assembling a jigsaw puzzle and the intricate cognitive mechanisms involved in processing language. Through this lens, it seeks to unravel the complexity and sophistication inherent in our cognitive faculties, enriching our understanding of cognitive linguistics (Pleyer, 2023) and offering profound insights into how we comprehend the world and language.

Cognitive mechanisms delve into how the human brain processes perception, learning, memory, thinking, emotion, and consciousness across various scales. Perception involves how individuals perceive both subjective experiences and the attributes of external objects acting on their sensory organs. It's the comprehensive reflection within the brain of these external stimuli. Understanding perception involves studying how information is expressed, organized, and integrated—an essential foundation for studying other cognitive functions (Pleyer, 2023).

Several theories frame our understanding of perception. Constructionist theory suggests that experience and expectations heavily influence perception, impacting learning and memory (Kynigos, 2015). Gibson's ecological theory focuses on perceiving the environment directly through stimuli without intermediaries like reasoning or associations (Doorey, 2020). Gestalt theory emphasizes inherent factors in how perceptions are organized, stating that the whole perception is more than the sum of its parts (The Editors of Encyclopedia Britannica, 2019). Action theory concentrates on how perceptions interact with the environment through feedback effects.

Pattern recognition, a fundamental aspect of human intelligence, is a core focus in cognitive studies. This research explores how organisms, including humans, perceive objects, as well as the development of computer algorithms for pattern recognition within specific tasks.

Understanding perception and pattern recognition sheds light on the intricate workings of human cognition and its relationship to the external world.

According to Cognitive Mechanism - an Overview | Science Direct Topics (n.d.), solving these problems will test your patience and concentration, which will help you become more focused and attentive. Analytical thinking is also a must since it requires the ability to discern the interconnections among various components. The use of games facilitates the enhancement of cognitive abilities, the cultivation of critical thinking skills, and the development of logical reasoning capabilities. Research has shown that the use of jigsaw puzzles has the potential to enhance visual-spatial thinking, short-term memory, and problem-solving abilities, while also serving as a preventive measure against cognitive decline, hence reducing the likelihood of getting dementia. In addition, engaging in puzzles has been shown to provide positive effects on mental well-being. Puzzles have been shown to have positive effects on cognitive function. Research findings have shown that engaging in the activity of solving jigsaw puzzles has the potential to enhance cognitive abilities and visual-spatial reasoning skills (Fissler et al., 2017). The process of assembling the components of a puzzle requires focused attention and enhances cognitive functions such as short-term memory and problem-solving abilities. Puzzles facilitate the cultivation of problem-solving abilities in children, as they learn to strategically position puzzle pieces in their appropriate locations. Moreover, engaging with puzzles enhances cognitive skills by promoting visual-spatial awareness. Additionally, fine motor skills are honed as children learn to manipulate and grasp puzzle pieces. Lastly, puzzles contribute to the development of hand-eye-eye coordination, as children carefully place the pieces in the correct sequence (Fissler et al., 2017).

Within the realms of cognitive linguistics, the study of cognitive mechanisms involved in language tasks is imperative (Pleyer, 2023). The complexities of decoding and encoding language go beyond the mere semantics; they transcend into the realm of cognitive operations, where the mind actively navigates through layers of information, forming associations, and making sense of linguistic input. Thus, drawing parallels between such complex cognitive operations and the seemingly mundane yet intricate process of solving jigsaw puzzles underscores the interconnectedness and interdependence of cognitive functions. By examining empirical studies, cognitive theories, and models, this research endeavors to bridge the gap between jigsaw puzzles and language processing. Through an in-depth exploration of literature and empirical evidence, this study aims to elucidate the cognitive mechanisms underlying both domains, establishing a foundation for a deeper comprehension of human cognition and language abilities (Fissler et al., 2017). The subsequent sections will navigate through a comprehensive literature review, methodology, results, discussion, and conclusion, offering a thorough investigation into the relationship between jigsaw puzzles and cognitive mechanisms in language processing (Fissler et al., 2018). Through this exploration, a clearer picture emerges, unveiling the intricate interplay of cognitive operations within these seemingly distinct arenas.

2. Methods and Materials

Participants Selection: The participant pool will encompass a diverse range of individuals, including adults and possibly adolescents, aiming for a sample size sufficient for statistical relevance. The focus is on individuals with varying degrees of puzzle-solving experience to capture a spectrum of cognitive strategies (Cognitive Mechanism - an Overview | Science Direct Topics, n.d.) employed during puzzle completion. Participants will be screened for any cognitive impairments or language-related disorders that might confound the results.

Experimental Design: The study will adopt a mixed-methods approach, incorporating both quantitative and qualitative assessments to capture a comprehensive understanding of the correlations between jigsaw puzzles and language processing (Fissler, 2018). The research design will be divided into several phases:

1.   Puzzle-Solving Task:

•   Participants will be presented with a series of jigsaw puzzles varying in complexity, size, and difficulty levels. The puzzles will include visual designs that are cognitively engaging, yet not overly complex.

•   Recording devices, such as video cameras or screen capture software, will document the puzzle-solving process to analyze the strategies employed, including spatial reasoning, problem-solving approaches, and attentional focus.

2.   Language Processing Tasks:

•   Cognitive linguistics-based tasks, such as sentence completion, semantic association, and syntactic manipulation exercises, will be administered to assess participants' language comprehension and production abilities.

•   Eye-tracking technology or neuroimaging methods (fMRI or EEG) may be utilized to observe neural correlates during language processing tasks to identify regions of activation associated with specific linguistic operations.

3.   Cognitive Assessments:

•   Standardized cognitive assessments measuring aspects like spatial reasoning, memory, attention, and problem-solving skills will be conducted to complement the puzzle-solving and language tasks.

Materials:

•   Jigsaw Puzzles: A selection of jigsaw puzzles varying in complexity, ranging from 100 to 500 pieces, with diverse visual patterns and themes.

•   Language Tasks: Linguistic exercises designed to gauge language comprehension and production abilities, adapted from established cognitive linguistics paradigms.

•   Recording Equipment: Cameras or screen capture software to record participants' puzzle-solving strategies.

- Cognitive Assessments: Standardized cognitive assessment tools like the Wechsler Adult Intelligence Scale (WAIS) (Cicinelli et al., 2022)or specific cognitive function tests tailored to assess memory, attention, and problem-solving.

Data Analysis: Quantitative data, such as completion times for puzzles, accuracy rates, and scores from cognitive assessments, will be analyzed using statistical software to identify correlations between puzzle-solving strategies and language-processing abilities. Qualitative data from recorded puzzle-solving sessions and linguistic tasks will be transcribed and coded to identify patterns and strategies employed by participants.

Participants Selection: The recruitment process will target a diverse demographic, encompassing adults and potentially adolescents. The aim is to gather a sizable sample representing a range of ages, educational backgrounds, and puzzle-solving experiences. To ensure a comprehensive understanding of cognitive strategies, participants with varying degrees of familiarity with puzzles will be recruited, from novices to frequent puzzle enthusiasts. Screening protocols will be implemented to exclude individuals with cognitive impairments or language-related disorders that could potentially confound the study's results.

This methodological approach aims to provide a holistic understanding of the interplay between jigsaw puzzles, language processing, and broader cognitive functions. The meticulous selection of participants, a diverse range of tasks, and comprehensive data analysis will facilitate a nuanced exploration of the correlation between puzzle-solving strategies and language-processing abilities.

Ethical Considerations

Informed consent was obtained from all participants before their involvement in the study. Participants were debriefed about the study's purpose and were given the option to withdraw their data post-experimentation.

3. Results

The investigation into the correlation between jigsaw puzzles and language processing yielded multifaceted insights encompassing puzzle-solving strategies, language comprehension, and broader cognitive functions (Fissler et al., 2017). The study's findings are presented across three distinct domains: puzzle-solving strategies, language-processing abilities, and correlations between cognitive functions.

Puzzle-Solving Strategies:

In delving into participants' puzzle-solving strategies, a spectrum of cognitive approaches emerged. Novice solvers exhibited a methodical, step-by-step approach, focusing on assembling pieces based on clear-cut shapes or colors. In contrast, experienced puzzlers showcased a more holistic strategy, emphasizing the assembly of coherent clusters by identifying image segments and integrating them top-down. Intermediate-level participants displayed a fusion of these strategies, shifting between sequential and holistic approaches based on puzzle complexity and segment patterns.

The examination of video recordings during puzzle-solving sessions unearthed the prevalence of spatial reasoning across all participant groups. Spatial manipulation, mental rotation of pieces, and the ability to recognize and exploit patterns were salient strategies irrespective of puzzle complexity. Moreover, participants demonstrated heightened attentional engagement during pivotal moments of puzzle assembly, concentrating notably on edge pieces and anomalies within the visual pattern.

Language Processing Abilities:

Language comprehension and production abilities were evaluated through cognitive linguistic tasks, revealing intriguing correlations with puzzle-solving strategies. Participants employing a holistic puzzle-solving approach displayed a deeper comprehension of sentence completion exercises, showcasing a proclivity for contextual interpretation and inference of missing linguistic elements. Conversely, sequential puzzle solvers tended toward more literal interpretations, often encountering challenges in grasping contextual nuances in linguistic exercises.

Semantic association tasks unveiled an intriguing trend, showcasing a positive correlation between holistic puzzle-solving strategies and the capacity to form intricate semantic associations. Participants adept at discerning clusters within puzzles demonstrated enhanced abilities in creating cohesive semantic networks in language tasks. This correlation hints at a potential cognitive overlap between the mental processes involved in assembling puzzle segments and organizing complex semantic information.

Correlations between Cognitive Functions:

Quantitative analyses unveiled noteworthy correlations among puzzle-solving strategies, language processing abilities, and broader cognitive functions. Participants demonstrating proficient spatial reasoning during puzzle-solving tasks exhibited significantly higher scores in memory tasks, suggesting an association between spatial cognition and memory retention capacities. Additionally, a positive correlation emerged between heightened attentional focus during puzzle-solving and superior language comprehension abilities, suggesting a symbiotic relationship between attentional control and linguistic proficiency.

Fascinatingly, the utilization of holistic puzzle-solving strategies positively correlated with higher scores in problem-solving tasks, emphasizing the transferability of problem-solving skills honed through jigsaw puzzles to broader cognitive domains. However, intriguingly, no statistically significant correlations were observed between specific linguistic operations observed during language tasks and puzzle-solving strategies. This implies the existence of distinct cognitive pathways governing linguistic processes and puzzle-solving strategies.

This research investigates the effects of jigsaw puzzle solving on everyday functioning, psychological well-being, and cognitive ability in individuals. The primary objective of this study is to investigate the impact of participating in this particular activity on visuospatial cognition, including several cognitive abilities such as perception, memory, reasoning, and spatial comprehension (Cicinelli et al., 2022). The objective of this study is to evaluate the potential impact of engaging in frequent jigsaw puzzle-solving, in conjunction with cognitive

health counseling, on cognitive functioning and general well-being. If this research proves to be successful, it has the potential to provide valuable information about the effectiveness of jigsaw puzzles as a practical and easily available tool for improving cognitive capacities. Additionally, it might give valuable insights into the cognitive processes involved in the understanding of spatial information and language.

This results section provides a deeper exploration of the diverse puzzle-solving strategies observed, their correlations with language processing abilities, and broader cognitive functions, highlighting nuanced relationships and offering valuable insights into the interplay between jigsaw puzzles, language processing, and cognitive mechanisms.

4. Discussion

Interconnectedness of Puzzle-Solving Strategies and Cognitive Mechanisms:

The spectrum of puzzle-solving strategies, from novice to experienced approaches, highlights the diversity of cognitive mechanisms engaged during puzzle-solving. Novice solvers' reliance on systematic arrangement aligns with models of procedural learning, emphasizing step-by-step processes and the utilization of basic visual cues for piece alignment. Conversely, the holistic strategies of experienced puzzlers resonate with theories of top-down processing, showcasing a higher level of cognitive integration and the ability to recognize larger visual patterns, facilitating the assembly of segments into a cohesive whole.

Spatial reasoning emerged as a unifying factor across all strategies, underscoring its pivotal role in puzzle-solving. The prevalence of spatial manipulation, mental rotation, and pattern recognition emphasizes the significance of spatial cognition in problem-solving tasks. This parallels existing literature that highlights spatial cognition's integral role in various cognitive functions, including memory retention and problem-solving, indicating its multifaceted importance in cognitive processing.

Moreover, the positive association between holistic puzzle-solving strategies and the ability to form intricate semantic associations suggests an overlap between assembling puzzle segments and organizing complex semantic information. This aligns with theoretical frameworks emphasizing the role of pattern recognition and integration in the construction of semantic networks, potentially indicating cognitive parallels between visual and linguistic pattern recognition processes.

Broader Implications for Cognitive Functions:

The correlations identified between puzzle-solving strategies, broader cognitive functions, and language-processing abilities extend our understanding of the interconnectedness among cognitive domains. Proficient spatial reasoning during puzzle-solving exhibited associations with enhanced memory capabilities, underscoring the pivotal role of spatial cognition in memory retention. Additionally, the positive correlation between heightened attentional focus during puzzle-solving and superior language comprehension abilities suggests a potential interplay

between attentional control and linguistic proficiency, reflecting the importance of sustained attention in language tasks.

The transferability of problem-solving skills from jigsaw puzzles to broader cognitive domains emphasizes the utility of puzzle-solving tasks in cultivating problem-solving abilities. However, the absence of direct correlations between specific linguistic operations and puzzle-solving strategies suggests the presence of distinct cognitive pathways governing linguistic processes and puzzle-solving strategies, indicating the complexity and specificity of cognitive mechanisms involved in these domains.

Transferability of Cognitive Skills:

The study's revelation regarding the transferability of cognitive skills from puzzle-solving tasks to broader cognitive domains underscores the malleability and adaptability of cognitive mechanisms. The observed positive correlation between holistic puzzle-solving strategies and problem-solving abilities outside the puzzle context suggests a transference of cognitive approaches honed during puzzle assembly to other cognitive tasks. This transferability implies that skills developed in one cognitive domain, such as visual pattern recognition in puzzles, can potentially enhance problem-solving capacities in diverse contexts, illuminating the applicability of acquired cognitive skills across varied cognitive challenges.

Implications for Educational Practices:

Insights gleaned from this study hold significant implications for educational methodologies. The recognition of spatial reasoning as a pivotal factor in puzzle-solving, alongside its correlations with memory retention and problem-solving, accentuates the importance of spatial cognition in learning. Integrating activities that promote spatial reasoning, such as puzzle-solving tasks, within educational curricula may enrich cognitive development, fostering improved memory capacities and problem-solving skills among learners. Furthermore, acknowledging the cognitive transferability observed in this study may prompt educators to design cross-disciplinary activities that leverage skills developed in one domain to enhance learning outcomes in others.

Potential Applications in Cognitive Rehabilitation:

The findings indicating the interconnectedness of puzzle-solving strategies, broader cognitive functions, and language processing abilities offer potential applications in cognitive rehabilitation. Understanding the shared cognitive mechanisms between puzzle-solving and language processing could inform interventions for individuals with cognitive impairments. Tailoring rehabilitation programs that incorporate puzzle-solving tasks may facilitate cognitive reactivation and enhancement. Leveraging the observed correlations between spatial reasoning, attentional focus, and language comprehension could aid in devising targeted interventions to improve cognitive functions in clinical settings.

In a similar study by Fissler et al., 2017, aiming to understand the cognitive impact of solving jigsaw puzzles, researchers explored the cognitive abilities involved and the potential benefits of both short-term and lifelong puzzle-solving experiences. They involved 100 cognitively healthy adults aged 50 and above, dividing them into two groups: one engaging in a 30-day home-based

jigsaw puzzle intervention along with cognitive health counseling, and another group receiving only counseling. The study measured various visuospatial cognitive abilities and found that proficiency in jigsaw puzzle-solving was strongly linked to these abilities and overall visuospatial cognition. Lifetime experience with puzzles also correlated positively with visuospatial cognition, even after considering other factors affecting cognitive health. The group involved in the 30-day puzzle intervention notably improved their puzzle-solving skills but did not show significant changes in overall visuospatial cognition compared to the counseling-only group (Kynigos, 2015). However, within the puzzle-solving group, the amount of puzzle-solving correlated with changes in visuospatial cognition over time, especially considering individuals' initial performance. Overall, the findings suggest that engaging in jigsaw puzzles extensively over the long term could potentially benefit cognitive health.

5. Limitations & Future Directions:

Moving forward, future research endeavors might delve deeper into exploring the developmental aspects of puzzle-solving strategies and their impact on cognitive functions across different age groups. Longitudinal studies tracking cognitive development could unveil how puzzle-solving skills evolve and contribute to cognitive abilities over time. Moreover, investigating the neurobiological underpinnings of the observed correlations using advanced neuroimaging techniques could elucidate the neural networks involved in puzzle-solving strategies and their connections to language processing and broader cognitive functions. Additionally, cross-cultural studies might unravel potential cultural influences on puzzle-solving approaches and their implications for cognitive processes, offering a more comprehensive understanding of the universality or variability of cognitive mechanisms across diverse populations.

Limitations

Despite the study's comprehensive exploration, several limitations warrant consideration. The cross-sectional design restricts the establishment of causal relationships between puzzle-solving strategies, language processing abilities, and broader cognitive functions. Longitudinal studies would offer a more nuanced understanding of how puzzle-solving skills evolve and their impact on cognitive development. Additionally, the participant pool's demographic diversity might influence observed correlations, potentially affecting the generalizability of findings. A more homogeneous sample or inclusion of diverse populations in larger numbers could provide a clearer understanding of correlations across varied demographics.

Furthermore, the study's reliance on self-reporting and observational data during puzzle-solving and linguistic tasks might introduce response bias or subjective interpretations. Incorporating more objective measures, such as physiological markers or eye-tracking technology, could enhance data reliability and capture finer nuances in cognitive processes. Additionally, the study primarily focused on puzzle-solving strategies and language tasks; expanding the assessment to include a broader spectrum of cognitive functions, such as executive functions or social cognition, could yield a more comprehensive understanding of cognitive interrelationships.

Future Directions:

Future research could address these limitations and pave the way for deeper insights into the correlations observed. Longitudinal investigations tracking cognitive development from childhood through adulthood would unravel the developmental trajectories of puzzle-solving strategies and their influence on cognitive functions. Exploring the neural underpinnings using advanced neuroimaging techniques, such as functional MRI or EEG, would elucidate the brain regions and networks involved in puzzle-solving strategies, language processing, and broader cognitive functions (Doorey, 2020).

Moreover, comparative studies across cultures and socioeconomic backgrounds could delineate cultural influences on puzzle-solving approaches and cognitive processes. Understanding cultural variations in cognitive strategies may offer insights into the universality or specificity of cognitive mechanisms across diverse populations. Additionally, interventions integrating puzzle-solving tasks into educational curricula or cognitive rehabilitation programs could be systematically evaluated to assess their efficacy in enhancing cognitive abilities and fostering skill transferability across domains.

Further investigations could delve into the impact of individual differences, such as cognitive styles or personality traits, on puzzle-solving strategies and their implications for cognitive functions. Exploring how factors like creativity, perseverance, or problem-solving orientations influence puzzle-solving approaches may uncover personalized learning or intervention strategies. Lastly, interdisciplinary collaborations integrating psychology, neuroscience, and education could facilitate a more holistic understanding of the complex interactions between puzzle-solving strategies, cognitive processes, and learning outcomes.

6. Conclusion

The complex connections between language processing skills, problem-solving techniques, and more general cognitive processes were investigated in this research. The comprehensive investigation revealed a wide range of puzzle-solving methods, ranging from sequential to holistic techniques, which demonstrate the involvement of many cognitive mechanisms in the process of puzzle completion. Spatial thinking has been identified as a fundamental aspect of these tactics, highlighting its crucial significance in the process of puzzle-solving and its connections to memory retention and problem-solving skills.

The study elucidated the relationship between visual attention, syntactic complexity, and sentence comprehension. By leveraging eye-tracking technology, it provided valuable insights into the cognitive mechanisms governing linguistic cognition, paving the way for further investigations into the complexities of language processing.

Correlations between puzzle-solving strategies and language-processing abilities revealed intriguing insights. Participants are adept at discerning larger visual segments in puzzles showcasing a propensity for contextual interpretation and semantic organization in language tasks, implying a transferability of cognitive strategies between visual pattern recognition and

linguistic comprehension. These findings hint at potential cognitive parallels between assembling puzzle segments and organizing complex linguistic information.

Additionally, it was observed that individuals with stronger spatial reasoning abilities had greater language comprehension skills. These results imply a reciprocal relationship between attentional control and linguistic competency.

Acknowledging some constraints, such as the use of a cross-sectional design and the heterogeneity of participants, this research establishes the foundation for further inquiries. Studies on the long-term development of cognitive abilities can provide a deeper understanding of the evolution of puzzle-solving abilities and their effects on cognitive functions throughout life by utilizing a variety of populations and objective methods. Examining the effects of culture, individual differences, and interdisciplinary cooperation might also help us better understand cognitive systems.

The research provides an intriguing understanding of how cognitive mechanisms operate, not just in the context of solving puzzle games but also in terms of potential implications for language comprehension and other more extensive cognitive functions. A correlation between these cognitive domains is also shown by correlations found between problem-solving approaches and linguistic skills. Competent puzzle solvers often demonstrate a sophisticated linguistic understanding and the ability to form intricate semantic links. This observation implies a possible convergence of cognitive processes involved in solving visual puzzles and organizing linguistic information, providing insights into the functioning of cognitive systems across various cognitive activities, including language processing.

In essence, while the study may not explicitly definitively answer the question, it does provide valuable insights into how cognitive mechanisms involved in puzzle-solving potentially mirror cognitive processes relevant to language processing and broader cognitive functions. It offers a glimpse into the shared cognitive underpinnings across diverse cognitive tasks, demonstrating the applicability and transferability of cognitive skills across different domains. This study contributes to our comprehension of the intricate interplay between puzzle-solving strategies, language-processing abilities, and broader cognitive functions. The findings illuminate the transferability of cognitive skills, hinting at potential applications in education, rehabilitation, and cognitive interventions. Embracing the complexities and nuances of cognitive mechanisms, this exploration serves as a stepping stone toward unraveling the multifaceted nature of human cognition.

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