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Category learning in children with ASD: a systematic review

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This systematic review aims to synthesize and analyze current research on the characteristics of category learning in children with autism spectrum disorder (ASD) within the framework of the COVIS model, which posits competition between explicit (verbal) and implicit (nonverbal) categorization systems. The review includes 40 empirical studies published between 1981 and 2025, selected according to PICO and PRISMA protocols from major scientific databases. The implicit system demonstrates relative preservation in perceptual learning tasks; however, pronounced difficulties emerge in tasks requiring abstract generalization (prototype formation) and feature integration. The explicit (verbal) system is characterized by persistent deficits in the understanding of abstract and social concepts, as well as reduced cognitive flexibility. A key conclusion of the review is the demonstrated effectiveness of structured explicit instruction as a means of compensating for these deficits. The analysis also reveals a significant methodological gap in the literature and underscores the need for studies specifically designed to investigate attentional mechanisms and category types within rigorous cognitive science paradigms. Such research may facilitate a shift from descriptive accounts of symptoms to a deeper understanding of the underlying cognitive mechanisms.

Keywords: cognitive development, category learning, autism spectrum disorder, COVIS, selective attention, distributed attention

Introduction

Categorical learning is one of the key cognitive functions that enable humans to systematize experience and think effectively about the world. It is known that adults, while learning categories, rely on selective attention, classifying an object to a certain category by focusing on relevant and ignoring irrelevant features for that category. In turn, children, up until early school age, rely on diffused attention, attending to all features of an object as a whole [Deng, Sloutsky, 2016; Goldstone, Steyvers, 2001; Rehder, Hoffman, 2005].

Autism spectrum disorder (ASD) is a behaviorally defined neurodevelopmental condition characterized by persistent difficulties in social communication and interaction, alongside restricted, repetitive patterns of behavior, interests, or activities, with onset in early development and significant impact on everyday functioning. Contemporary diagnostic systems such as DSM-5 and ICD-11 conceptualize ASD as a single spectrum that encompasses a wide variety of symptom profiles, developmental trajectories, language and cognitive abilities, adaptive skills, and comorbid conditions, leading to pronounced clinical and etiological heterogeneity [Kamp-Becker, 2024].

Individuals with ASD often show difficulties in multiple domains of executive functioning, including inhibitory control, cognitive flexibility, working memory, planning, and problem solving, even when intellectual abilities are within the typical range. Such executive function (EF) difficulties are closely linked to everyday challenges in social communication and adaptive behavior, and have been associated with both "cold" EF processes (e.g., shifting, inhibition) and "hot" EF processes related to emotional and social regulation [Wang et al., 2025].

Category learning is a higher-order cognitive process that relies on the interaction between executive control, attention, and feedback-based learning mechanisms. Children with autism spectrum disorder generally retain the basic ability to form categories: studies show many children with ASD can learn to name and sort objects by categories, mastering simple concepts [Mercado et al., 2020]. Research reveals qualitative differences in how children with ASD acquire categories; specifically, it has been found that the categories formed by individuals with autism can differ significantly from those typically identified by neurotypical individuals, pointing to a different strategy of information processing and generalization in children with ASD [Church et al., 2010; Froehlich et al., 2012; Gastgeb et al., 2012]. Previous empirical studies have shown that children with ASD use selective attention when learning new categories related to prototypes, unlike their neurotypical peers [Luzhnova, Kotov, 2024].

Problem of current research

This study seeks to systematize data on attention mechanisms in children with ASD during categorical learning. Although some studies have shed light on certain aspects (e.g., difficulties with prototype formation, excessive attention to detail, etc.), categorical learning in children with ASD is insufficiently studied systematically. Moreover, there is a lack of reviews addressing categorical learning in children with ASD from the perspective of a single cognitive paradigm that considers both diagnosis features and the mechanisms of categorical learning. Thus, there is a need for a literature review that would shift the focus from isolated aspects of learning to synthesizing the acquired data within a unified theoretical model.

For this review, the COVIS (Competition between Verbal and Implicit Systems) model was selected. The COVIS model is a cognitive model proposed to explain processes of categorical learning [Ashby et al., 2011]. Importantly, the model combines psychological and neurobiological perspectives on categorical learning and has proven itself in studies on other conditions, for example, Alzheimer's disease [Phillips et al., 2017]. Dual-system models such as COVIS propose that category learning can proceed either through an explicit, hypothesis-testing verbal system that depends on working memory and selective attention, or through a gradual, procedural system supported by cortico-striatal circuits [Chandrasekaran et al., 2014]. According to COVIS, rule-based category learning is particularly reliant on executive functions, whereas information-integration learning depends more strongly on implicit, procedural mechanisms. Given the robust evidence for executive function difficulties in ASD, category learning tasks situated within the COVIS framework offer a useful lens for probing how verbal rule-based and implicit procedural learning systems may be differentially affected in this population.

This model recognizes two different types of category learning systems: the verbal system (rule-based) and the implicit system (similarity-based). Verbal categories are defined by explicit, verbalizable rules, often based on a single diagnostic feature. Learning this category type depends on the explicit system, linked to the prefrontal cortex and hippocampus, and success in such tasks improves when clear instructions

are given and hypotheses can be tested.

By contrast, implicit categories cannot be learned by a simple verbalizable rule and require the integration of several perceptual features into a single, often unconscious, solution. Here, learning relies on the implicit, procedural system (striatal, especially the body and tail of the caudate nucleus) and critically depends on immediate feedback necessary for forming correct stimulus-response associations [Minda et al., 2024].

Method

The review used the PICO methodology for inclusion of articles (Population: children with ASD; Intervention: categorical learning tasks; Outcome: categorization success; Comparison: neurotypical groups, if available), with peer review and experimental section as inclusion criteria [Schardt et al., 2007]. Each paper was analyzed and assigned to either the implicit or verbal category type per the COVIS model. Although the selected papers did not use COVIS in its original form and some research preceded the model's development, classification of articles into these two category types is possible based on experimental design. For example, papers with prototype or visual search tasks were assigned to the implicit type, those with semantic tasks to the verbal type (Appendix 1).

The main analysis included empirical studies (children and adolescents with ASD) on categorization and categorical learning tasks. Excluded were papers without categorization/categorical learning data, or those performed entirely on adults without a child/adolescent sample (except for contextual comparisons), reviews without primary data, and clearly clinical or neurological studies.

Literature searches were conducted in multidisciplinary and specialized databases: PsycINFO, ERIC, MEDLINE/PubMed, Scopus, Web of Science, Embase, Cochrane Library. Keywords were combined using PICO methodology components [Schardt et al., 2007]: for population—autism spectrum disorder, autism, ASD, autistic children; for intervention/outcome—category learning, categorization, concept formation; the control group was specified if necessary (typically developing, neurotypical). Example search for PubMed/MEDLINE: [["Autism Spectrum Disorder"[Mesh] OR autis*[tiab] OR ASD[tiab] OR autistic[tiab]] AND ["Child"[Mesh] OR "Adolescent"[Mesh] OR child*[tiab] OR pediatric[tiab] OR adolescen*[tiab]] AND [categorization[mh] OR "Category Learning"[mh] OR "Concept Formation"[mh]]]. Additional equivalents or subject heading explosions were used as appropriate for each database.

In this review only peer-reviewed journal articles written in English and indexed in major scientific databases were included. Dissertations, theses, conference abstracts, and other forms of grey literature were not considered. Studies were eligible for inclusion if they: (a) reported original empirical data on individuals with a clinical diagnosis of ASD according to contemporary diagnostic standards (e.g., DSM-III/IV/5, ICD-10/11, and/or standardized instruments such as the ADOS/ADI-R); (b) employed an experimental task that operationalized category learning; and (c) provided quantitative behavioral outcomes (e.g., accuracy, learning curves, error patterns) for the ASD group, with or without a neurotypical comparison group. Exclusion criteria were: (a) theoretical or review articles without original data; and (b) case studies or reports with insufficient behavioral data for synthesis.

Titles and abstracts were initially screened by one reviewer with expertise in cognitive development in children with ASD, under the supervision of a second specialist focused on category learning. Full texts of potentially eligible articles were then assessed against the predefined inclusion and exclusion criteria. Any uncertainties regarding eligibility were discussed with the supervising specialist until agreement was reached. Convergence of findings across studies was evaluated qualitatively by examining the consistency in the direction and pattern of group differences (ASD vs. neurotypical controls) and within-group associations (e.g., with IQ or symptom severity) for comparable COVIS-based tasks, rather than via formal meta-analysis, given the heterogeneity of samples, task designs, and outcome measures.

After merging the outputs, deduplication occurred, then a two-stage screening (titles/abstracts, then full texts) per PRISMA protocol [Page et al., 2021]. The initial set comprised 195 records for the context corpus published between 1981 and 2025. At screening and full-text assessment stages, 155 works were excluded; 40 publications entered the summary table, with the "modern core" (≥2013) — 7 articles. The research sample consisted mostly of children and adolescents; 15 studies had control groups (see Fig. 1).

For included papers, the following were recorded: experimental design, sample (age, diagnosis), category type (verbal vs. implicit), results. Synthesis was narrative, mapping results to the COVIS dichotomy.

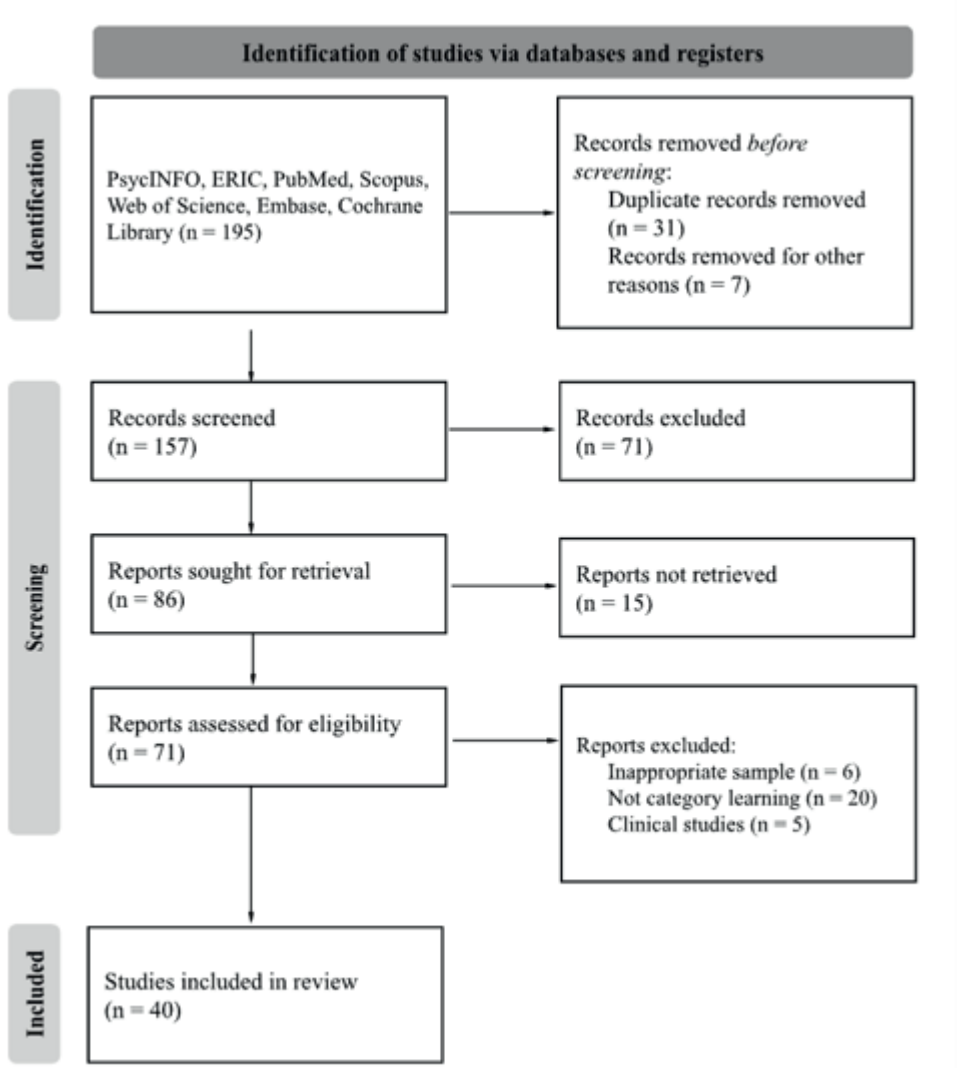

Figure 1. *Selection of studies for systematic analysis per PRISMA protocol.*

Results

Of the 40 included studies, 15 directly compared individuals with ASD to neurotypical control groups, whereas 25 studies examined only ASD samples without a control condition. Clinical descriptions across studies commonly emphasized core social-communication difficulties and restricted, repetitive patterns of behavior, but the level of detail regarding symptom severity, developmental history, and comorbidities varied widely. Several studies explicitly focused on subgroups defined by diagnostic labels used at the time (e.g., Asperger's disorder, pervasive developmental disorder not otherwise specified), which further contributes to heterogeneity in the clinical profiles represented across the COVIS-based category learning literature in ASD. In line with broader work on cognitive profiles in ASD, many samples were characterized by uneven abilities (e.g., relative strengths in non-verbal reasoning alongside weaker language or socio-emotional skills), although only a subset of papers reported such profiles systematically. This variability in reporting limits the extent to which specific symptom patterns can be linked to particular category learning outcomes in a quantitative manner.

All 40 included studies conceptualized category learning within the COVIS framework, typically contrasting rule-based and information-integration category structures under feedback-based learning conditions. No empirical papers using alternative paradigms of category learning in ASD met our eligibility criteria. Accordingly, the present review provides a focused synthesis of how COVIS-consistent tasks have been used to probe explicit [verbal, hypothesis-testing] and implicit (procedural) learning systems in individuals with ASD, rather than a comprehensive overview of all possible approaches to categorical learning in this population.

According to the COVIS model, the studies were conventionally divided into two groups: those that

mainly investigate implicit forms of categorization, and those focusing on verbal categories. Out of the 40 selected articles, 15 were classified as studies on implicit categories and 25 as studies on verbal categories. All studies included participants with ASD, and in 15 studies there was also a control group—neurotypical peers (NT) and/or peers with intellectual disabilities (ID).

Implicit Categories

In implicit category-learning tasks, autistic children often perform well on simple matching-to-sample procedures and basic perceptual class formation, yet show characteristic difficulties as task complexity increases. For instance, in prototype and family-resemblance paradigms using faces or dot patterns, they are less likely to abstract a central prototype and instead rely on isolated, salient features, leading to fragmentary classifications and miscategorization of stimuli that share the 'overall look' but lack a single dominant detail. In free-classification and unsupervised learning tasks, increasing dimensionality typically elicits a shift toward rigid unidimensional strategies (e.g., grouping objects only by the length of one element while ignoring other relevant features), which results in systematic errors whenever successful performance requires flexible integration of multiple dimensions.

Research aimed at assessing implicit forms of categorization shows that many basic abilities in individuals with ASD may be preserved or develop in a unique way. Two studies have found no deficits in sensorimotor development [Morgan et al., 1989] and in performing simple nonverbal Piagetian tasks [Lancy, Goldstein, 1982, Morgan et al., 1989]. Moreover, there is evidence of the ability to form perceptual classes and conditional relationships through "matching-to-sample" procedures [Maguire et al., 1994; Tager-Flusberg, 1985b].

However, at a more complex level, requiring abstraction and integration of information, persistent difficulties are identified. For example, individuals with ASD exhibit significant difficulties in forming prototypes [Klinger, Dawson, 2001; Gastgeb et al., 2009; Gastgeb, et al., 2012] and in using the "family resemblance" strategy, that is, categorization not by clear rules or individual features, but by overall similarity between a new object and many other members of the category [Church et al., 2010]. This indicates weakness in implicit generalization and prototype extraction. An atypical learning trajectory is also confirmed in studies on categorical induction, where it proceeds more slowly and with different strategies compared to neurotypical peers [Soulières et al., 2011].

As cognitive load increases in free classification tasks, participants with ASD tend towards unidimensional (accounting for only one feature, e.g., grouping only by leg length while ignoring the body of an experimental design object), rather than multidimensional solutions (accounting for several features) [Edwards et al., 2012], which may be due to difficulties in feature integration and the specifics of executive functions [McGonigle-Chalmers, Alderson-Day, 2010]. Interestingly, in areas that do not require complex integration, an advantage can even be observed, such as more effective visual search compared to neurotypical participants [Kaldy et al., 2016], once again highlighting the dissociation between learning systems.

The implicit categorization system in ASD demonstrates relative preservation at the level of elementary sensorimotor and perceptual learning. Key deficits are manifested at the level of abstract generalization (prototype formation) and flexible integration of multiple features, which may underlie the difficulties in forming holistic categories and atypical learning paths.

Verbal Categories

In verbally mediated tasks, difficulties become more pronounced when abstraction and social meaning are required. In vocabulary tests targeting emotional and abstract concepts (e.g., 'hope', 'disappointment'), autistic children tend to provide literal, situationally narrow, or tangential explanations and frequently fail to select context-appropriate meanings, while performance on concrete words is relatively preserved. In theory-of-mind and perspective-taking tasks, such as false-belief scenarios or contextually demanding questions, errors often reflect reliance on the child's own knowledge rather than the character's limited perspective, with insufficient use of contextual cues. At the same time, intervention studies using structured concept-mastery routines or tact-to-intraverbal training show that when categories and social concepts are taught through stepwise, explicit instruction, children progressively move from simple naming to more complex verbal relations (e.g., answering 'why is this…?' questions), with a noticeable reduction in generalization and transfer errors.

Studies of verbally mediated and categorical learning reveal more systematic and pronounced difficulties in ASD. Numerous works indicate deficits in areas closely related to language and social cognition. In particular, understanding and use of abstract,

emotional, and social concepts suffer [Hobson, Lee, 1989; Bormann-Kischkel et al., 1995; Vigliocco et al., 2018]. Significant difficulties are observed in tasks requiring theory of mind (ToM) and understanding others' mental states [Leslie, Thaiss, 1992; Reed, 1994], which suggests a domain-specific deficit in the social-conceptual sphere. In addition, individuals with ASD characteristically have problems with executive control, such as flexible switching between rules and categories [Rumsey, 1985; Alderson-Day, McGonigle-Chalmers, 2011]. An important aspect is that the basic ability for categorization itself may be preserved [Tager-Flusberg, 1985a], but its link with receptive language proves to be less automatic and robust [Ungerer, Sigman, 1987].

At the same time, research shows that these deficits can be compensated with structured teaching. The use of explicit strategies such as concept mastery routines (learning concepts according to a structured plan or "routine") [Laushey et al., 2009] or tact-to-intraverbal training procedures [teaching the transition from simple naming (tact) to more complex verbal relations (intraverbal) [Grannan, Rehfeldt, 2012] leads to successful acquisition, maintenance, and generalization of categorical and social concepts. This indicates that the verbal system remains receptive to targeted pedagogical intervention even in the presence of initial difficulties.

Discussion

Analysis of 40 empirical studies revealed a qualitative dissociation in the functioning of category learning systems in children with ASD, in accordance with the COVIS model. The main conclusion that can be drawn from the data analysis is that children with ASD show significantly greater success in mastering implicit categories compared to verbal ones. The implicit system, based on perceptual and sensorimotor processes, in children with ASD often remains intact or even enhanced. Studies show that groups of children with ASD may not differ from control groups in accuracy on matching-to-sample tasks, and in some areas, such as visual search, may even demonstrate an advantage. In contrast, the verbal categorization system, which requires abstraction, flexibility, and contextual integration, presents a pronounced area of difficulty. Children with ASD experience challenges in acquiring concepts through instructions, formal discrimination, and understanding emotional and abstract concepts. Thus, implicit categories based on direct perceptual experience are learned more easily by children with ASD and are their area of strength, whereas verbal categories, which are related to symbolic representation and abstract thinking, present the greatest difficulty.

The implicit system demonstrates relative preservation in simple sensorimotor learning and perceptual generalization tasks but faces persistent difficulties with abstraction and feature integration, manifested as deficits in prototype formation and a tendency toward unidimensional strategies. At the same time, the verbal system is characterized by pronounced deficits in mastering abstract, social, and emotional concepts, as well as in tasks that require flexible thinking and theory of mind.

When mastering verbal categories, children with ASD demonstrate specific difficulties related to abstract and context-dependent thinking. Studies have found reduced ability for formal discrimination, especially with increasing task complexity, difficulties in acquiring concepts through verbal instructions, and significant weakness in mastering emotional and abstract concepts. In contrast, the domain of implicit categorical learning, which is based on perceptual and sensorimotor processes, is much more preserved. Children with ASD successfully cope with simple sensorimotor matching tasks and even show advantages in some aspects of visual search. However, specific deficits are also found here—difficulties in prototype formation, weak integration of perceptual features, and atypical global information processing, which are associated with features of central coherence, meaning the tendency to process information globally and holistically, extracting the main meaning and context by combining individual details into a meaningful whole [Gambra et al., 2024].

The obtained results correlate with the executive function (EF) theory, a key model of ASD that explains difficulties in inhibitory control, cognitive flexibility, working memory, and planning, even in the presence of preserved intelligence. Deficits in verbal categorization are directly linked to problems with set-shifting [Rumsey, 1985; Alderson-Day, McGonigle-Chalmers, 2011] and inhibition, particularly in emotional-social regulation, which affects theory of mind (ToM) and abstract concepts [Leslie, Thaiss, 1992].

The data are also consistent with the previously introduced description of ASD as a spectrum with clinical heterogeneity [Kamp-Becker, 2024], where EF deficits modulate categorization: from preserved basic abilities [Mercado et al., 2020] to qualitative differences in strategies [Froehlich et al., 2012].

ASD is characterized not by a uniform EF deficit, but

by a spectrum ranging from pronounced impairments to preserved or even enhanced abilities, depending on cognitive level, language, and subtype, which elaborates on the aspects of uneven cognitive profiles introduced earlier. In low-functioning individuals, global difficulties in planning and flexibility predominate [Rumsey, 1985], whereas high-functioning individuals demonstrate strengths in selective attention and visual search [Kaldy et al., 2016; Luzhnova, Kotov, 2024].

This variability explains the heterogeneity in COVIS-related results: EF deficits exacerbate verbal difficulties (ToM, abstract rules) but do not compromise implicit strengths [Tager-Flusberg, 1985], thereby amplifying the introduced gap in systematic studies of attention and category types.

Heterogeneity of samples (subtypes, comorbidities), small sample sizes ($n<30$ in most studies), and the lack of standardized COVIS-based tasks limit generalizability, particularly for post-2012 data, as noted in the introduction. A temporal gap in the literature (1985–2012) fails to reflect modern ASD frameworks [DSM-5/ICD-11].

Future research is needed to investigate attention mechanisms (selective vs. distributed) [Deng, Sloutsky, 2016], category types, and feedback within rigorous cognitive paradigms, using larger samples and dimensional measures (symptom severity, IQ), in order to transition from description to underlying mechanisms, as emphasized in the introduction.

Conclusion

Children with ASD demonstrate greater success in mastering implicit categories (perceptual-sensorimotor), where the system is often preserved or enhanced (e.g., in matching-to-sample and visual search), compared to verbal ones requiring abstraction, flexibility, and integration, where pronounced deficits are observed (instructions, emotional/abstract concepts). Deficits represent qualitative differences in strategies — perceptually-oriented pathways instead of automatic generalization in neurotypicals — making perceptual categories a strength and abstract/social ones a challenge

There is a critical lack of studies that systematically investigate how key parameters influence categorical learning in ASD. There is no single, valid assessment procedure that would allow comparison of the operation of different learning systems under controlled conditions. Thus, a promising area for future research is a shift from phenomenological clinical description to rigorous experimental design within the framework of cognitive science.

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Supplementary materials

Analytical Table of Selected Articles

Sample*	Method	Task Type	Results	Conclusions	Year	Authors
Verbal categories (by COVIS)						
ASD, ID	Leiter (Arthur adaptation)	Perceptual-conceptual	High performance in specific discrimination, but worse in formal discrimination	Better in specific, worse in formal discrimination	1981	Maltz A.
ASD (high-verbal), NT	WCST (conceptual problem solving)	Rule-based/ executive	Flexibility impairments (set-shifting)	Evidence for executive control deficits in ASD	1985	Rumsey JM.
ASD, ID, NT	Word meaning; basic/ superordinate levels	Semantic/ hierarchical	Groups equivalent on several understanding measures	Categorization per se is not necessarily impaired	1985	Tager-Flusberg H.
ASD	Categories: function/ form/color + receptive speech	Semantic	Weaker “category–receptive speech” link in ASD	Categorization ≠ automatic driver for language growth	1987	Ungerer JA et al.
ASD (PIQ≥70)	WISC, spatial/size understanding, gesture imitation	Perceptual-conceptual	Difficulties acquiring concepts from verbal instructions	Reduced symbolic-representative functions	1987	Ohta M.
ASD	Classification tasks	Conceptual	Difficulties solving classification tasks	Difficulties in classification tasks	1988	Slotnick CF.
ASD	British Picture Vocabulary Scale	Semantic (emotions/ abstractions)	Weakness in emotional/abstract conceptual domains	Socio-emotional semantics vulnerable	1989	Hobson RP et al.
ASD	Understanding beliefs vs maps/ pictures	Theoretical/ conceptual (domain-specific)	Poor false-belief task results despite preserved map representations	Domain specificity: ToM-specific deficit	1992	Leslie AM et al.
ASD	Categorization strategy training (one-/ two-/three-dimensional sorting)	Trainable/ strategic	Skill is learned, maintained, and generalized	Effectiveness of explicit strategy and step-by-step instruction	1994	Bock MA.
ASD	3 perspective-taking tasks (incl. Sally-Anne)	Social-cognitive	Failures on tasks with transitional/ less predictable stimuli	Context and transience critical for ToM	1994	Reed T.
ASD	Responses to contextually complex questions	Pragmatic/ conceptual	Higher frequency of pragmatic errors	Need for explicit contextual cues	2007	Loukusa S et al.

ASD	Emotional concepts understanding assessment	Semantic (emotions)	Differences in structure/use of emotional concepts	Uneven development of emotional semantics	1995	Bormann-Kischkel C et al.
ASD	Writing/ replication	Integration	Feedback: possible shift due to reproduction bias	Methodological caveats regarding perceptual-conceptual link	2009	Chen F.
ASD	Complement syntax vs false belief	Semantic (language–ToM)	Link between complementation and ToM task success	"Hacking out" strategy via language	2009	Lind SE et al.
ASD (high-functional)	Concept Mastery Routines (CMR) for social skills	Trainable (social)	Growth in social skills after CMR intervention	Structured concept routines are useful	2009	Laushey KM et al.
ASD (high-functional), NT	Category induction (rule/ item conflict)	Inductive/ hybrid	Induction possible, but slower/different route	Atypical strategies	2011	Soulières I et al.
ASD	Use of categories in problem solving	Conceptual	Difficulties with abstract content	Reliance on concrete information	2011	Alderson-Day B et al.
ASD, NT	Gender categorization of faces; typicality	Social/ perceptual	Typicality effect influences development trajectories	Stimulus typicality in diagnostics/ teaching	2012	Strauss MS et al.
ASD	Tact-to-intraverbal protocol	Verbal generalization	Emergence of untrained intraverbal responses	Effectiveness of combined protocol	2012	Grannan L et al.
ASD	Category induction	Inductive	Residual difficulties at OO status	No full normalization of abstractions	2013	Naigles LR et al.
ASD	Statistical word learning + fast mapping	Semantic (statistical learning)	Statistical learning preserved; fast-mapping weak	Subsystem heterogeneity in language learning	2017	Haebig E et al.
ASD, NT	Drawing/ identification of early concepts	Conceptual/ symbolic	Differences in depictions/labels of AAC symbols	Implications for AAC symbols	2018	McCarthy JW et al.
ASD	Vygotsky Blocks Test (solution styles)	Conceptual/ executive	Different solution styles	Role of language/social context in development	2018	Constable PA et al.
ASD, NT	Abstract words/ concepts	Semantic (abstractions)	Risks when acquiring abstractions in atypical groups	Interventions: embodiment, context, emotionality	2018	Vigliocco G et al.
Sample*	Method	Task Type	Results	Conclusions	Year	Authors
Implicit categories (by COVIS)						

ASD, ID	Pre-symbolic prerequisites (imitation, mental images)	Symbolic/ conceptual	Able to form mental images, difficulties with purposeful manipulation	Early symbolic representation deficits – consider in teaching	1981	Hammes JG et al.
ASD, ID, NT	Nonverbal Piagetian tasks	Conceptual (logical-operational)	Design excluded language confounds	No language deficit impact in Piagetian tasks	1982	Lancy DF et al.
ASD, ID, NT	Matching-to-sample with pictures	Semantic/ hierarchical	Similar accuracy between groups	No specific deficit in abstract category formation	1985	Tager-Flusberg H.
ASD, ID, NT	Sensorimotor scales (Uzgiris & Hunt, Dunst rev.)	Sensorimotor/ conceptual	Groups did not differ in total performance	Sensorimotor level can be preserved	1989	Morgan SB et al.
ASD	Matching-to-complex-sample; stimulus classes	Perceptual/ generalization	Possible to form conditional links and classes	Shows potential for stimulus equivalence	1994	Maguire RW et al.
ASD	Prototype tasks	Prototype	Difficulties abstracting prototypes	Weakness of “family resemblance” as a cue	2001	Klinger LG et al.
ASD, NT	Holistic semantic memory + face recognition	Integration (central coherence)	Weak connection between conceptual and perceptual integration	Doubt about a single “integration mechanism”	2008	López B et al.
ASD, NT	Copying paradoxical (impossible) figures	Perceptual/ Gestalt	Less influence of geometric impossibility in ASD	Atypical global integration	2009	Sheppard E et al.
ASD	Face prototype formation	Prototype (social)	Difficulties abstracting facial prototypes	Insight into face processing deficits	2009	Gastgeb HZ et al.
ASD, NT	Personification/ gaze categorization	Social	Mutual gaze helps neurotypical peers, not ASD	Social cues do not facilitate categorization	2009	Pellicano E et al.
ASD (high-functional), NT	Free classification (free serial search)	Executive/ conceptual	Differences in spontaneous search organization	Connection of classification and EF	2010	McGonigle-Chalmers M et al.
ASD (high-functional)	Dot-patterns (prototype vs exemplar)	Prototype	Less reliance on “family resemblance”	Impacts social categorization	2010	Church BA et al.
ASD	Unsupervised categorization	Unsupervised	More unidimensional sorting with increased task complexity	Limited feature integration	2012	Edwards DJ et al.
ASD	Dot-patterns (categories & prototypes)	Prototype	Difficulties forming categories/ prototypes	Deficit may be domain-general	2012	Gastgeb HZ et al.

ASD	Visual search (single vs conjunction)	Perceptual/ attention	Advantage in visual search	Attention features may outweigh perceptual explanation	2016	Kaldy Z et al.

ASD – autism spectrum disorder, ID – intellectual disabilities, NT – neurotypical peers

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Conflict of Interest

The author declares no conflict of interest.

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Категориальное научение у детей с РАС: систематический обзор

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Данный систематический обзор направлен на обобщение и анализ современных научных данных о специфике категориального научения детей с расстройствами аутистического спектра (РАС) в контексте модели COVIS, предполагающей конкуренцию между эксплицитной (вербальной) и имплицитной (невербальной) системами категориального научения. В обзор включены 40 эмпирических исследований (1981–2025 гг.), отобранных по протоколам PICO и PRISMA из крупных научных баз данных. Имплицитная система демонстрирует относительную сохранность в перцептивных задачах обучения, однако выраженные трудности проявляются в заданиях, требующих абстрактной генерализации (формирования прототипов) и интеграции признаков. Вербальная система характеризуется стойкими дефицитами в понимании абстрактных и социальных понятий, а также в когнитивной гибкости. Ключевым выводом является подтвержденная эффективность структурированного явного обучения как средства компенсации этих дефицитов. Обзор выявляет значительный методологический пробел в литературе и подчеркивает необходимость исследований, специально направленных на изучение механизмов внимания и типов категорий в рамках строгих когнитивно-научных парадигм, что позволит перейти от описания симптомов к пониманию лежащих в их основе когнитивных механизмов.

Ключевые слова: когнитивное развитие, категоризационное научение, расстройства аутистического спектра, COVIS, селективное внимание, распределенное внимание

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