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Lexicogrammatical Choices and Cognitive Patterns in Autism Spectrum Disorder: Insights from Self-Other Differentiation and Sense of Agency

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ABSTRACT

This study investigates key lexicogrammatical differences between individuals with Autism Spectrum Disorder (ASD) and non-ASD individuals, utilizing a corpus of spoken language from both ASD and non-ASD participants. Participants included 54 individuals with ASD (mean age = 20, SD = 6.83) and 70 non-ASD individuals (mean age = 21, SD = 6.72), all aged 15 and older. Framed within the Systemic Functional Linguistics model, the analysis focused on the TRANSITIVITY system, which organizes human experiences into six Process Types: Material, Mental, Relational, Behavioral, Verbal, and Existential. TRANSITIVITY system is essential for representing human experiences by categorizing them into processes, participants, and circumstantial elements. A t-test revealed a significant difference in the use of Existential Processes, with ASD individuals showing a higher frequency of expressions, such as *aru* (exist: inanimate) and *iru* (exist: animate), compared to non-ASD individuals. This suggests that individuals with ASD favor direct, concrete expressions of existence, which align with the ecological self—a cognitive orientation focused on immediate, physical interaction with the environment. This contrasts with more relational or socially mediated language, revealing distinct cognitive patterns in how ASD individuals perceive the world. The study examines the role of cognitive profiles in shaping lexicogrammatical choices, particularly in relation to self-other differentiation and agency. These findings underscore the link between cognitive functioning and language use, offering insights for ASD diagnosis. No prior studies have used lexicogrammatical choices as diagnostic markers for ASD, providing new perspectives on the relationship between cognition and language, with

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significant diagnostic implications.

Keywords: Systemic Functional Linguistics; Autism Spectrum Disorder; Cognition; Corpus; Pragmatic Impairment; Ecological Self; Self-Other-Differentiation

1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by persistent difficulties in social communication and interaction across diverse settings, along with repetitive behaviors and restricted interests[1]. A key manifestation of ASD is pragmatic impairment (PI), which refers to challenges in the effective use of language for social purposes[2, 3]. PI impacts an individual's ability to adjust language to suit different contexts, understand non-literal language such as idioms or sarcasm, and manage social subtleties vital for interpersonal communication. Unlike structural or grammatical language deficits, PI specifically affects the pragmatic dimension of language, impeding successful social exchanges.

Clinical researchers widely agree that PI should be studied through a multidimensional approach, incorporating linguistic, nonverbal, and cognitive aspects. Previous research highlights that PI may be associated with dysfunctions across various domains, including neurological, cognitive, symbolic, and sensorimotor factors[4–9]. Perkins[4] outlines four key domains involved in pragmatics—semiotic, cognitive, motor, and sensory—and identifies cognitive dysfunction as the primary cause of PI, with linguistic and sensorimotor factors considered secondary.

Previous studies have explored linguistic aspects of ASD from a cognitive perspective, focusing on areas such as modality, relative clauses, and syntax[3, 10–20]. Research on modality, in particular, underscored by Perkins[21], Nuyts and Roeck[11], and Kato[12], demonstrates that individuals with ASD exhibit a limited understanding and use of epistemic modal expressions. They tend to use fewer modal expressions related to *probability* and *evidentiality*, suggesting a link between cognitive processes involved in reasoning and the linguistic encoding of probability and evidence. These findings underscore the relationship between linguistic behavior and underlying cognitive functions in individuals with ASD.

McDonald[22] emphasized the crucial role of executive functions in cognitive processing, linking executive function with the ability to generate inferences. The findings suggested that impairments in executive function are closely associated with deficits in inferential reasoning, where greater impairments lead to more significant difficulties. Autistic children face challenges when navigating contexts that lack explicit information, as they tend to rely more heavily on general or social knowledge. They often exhibit a preference for deductive reasoning over inductive reasoning[10, 23, 24]. This bias in reasoning has a notable impact on their interpretation and use of modal expressions, such as *must*[10], underscoring broader difficulties in utilizing context to derive meaning, particularly in the realms of probability and evidentiality.

The ability to infer meaning in individuals with ASD is connected not only to Executive Function Theory[25–28] but also to other cognitive frameworks such as the Empathizing-Systemizing Theory[29, 30] and Weak Central Coherence Theory[31–34]. Research on central coherence[35–38] reveals that individuals with ASD often face difficulties in interpreting and generating non-verbal cues, such as facial expressions and gaze direction. This difficulty arises from a struggle to integrate diverse contextual information and to prioritize socially relevant cues, which impairs their ability to process and infer meaning in complex social contexts.

One effective approach to mapping the PIs in individuals with ASD is through the use of corpora. Though there is limited research in this area, Parish-Morris et al.'s[39] English corpus stands out for analyzing conversational features, such as speaking rate and inter-turn gaps between ASD and non-ASD individuals, although this corpus is not publicly available. Among accessible resources, the Nadig ASD English Corpus[40] offers transcripts of videotaped free-play sessions between children with ASD and their parents, although it lacks semantic annotations. Another significant resource is the Asymmetries ASD Corpus[41], which focuses on the spoken language of Dutch-speaking individuals with ASD and their typically developed peers, also in a raw, unannotated format.

In studies focusing on Japanese-speaking individuals

with ASD, Sakishita et al.[42] and Kato et al.[43] stand out for their use of specialized corpora tailored to their research objectives. Sakishita's corpus includes 17 types of annotations, adapted from the publicly accessible Chiba 3 Party corpus[44], with an emphasis on phonetic aspects of spoken language. This corpus allows for statistical analysis of annotations, morpheme data, and their connections to Autism Diagnostic Observation Schedule (ADOS) scores. In contrast, Kato et al.[43] developed an expansive annotation scheme, focusing on syntax and lexicogrammar in the spoken language of individuals with and without ASD. This scheme covers 159 annotation items, derived from transcripts of ADOS-2 assessments. The corpus was built on the principles of Systemic Functional Linguistics (SFL), offering a comprehensive, functionally based analysis of language. Notably, this corpus represents the first comprehensive lexicogrammatical annotation of ASD individuals' spoken Japanese. Both studies illustrate the emphasis on creating specialized corpora to better understand the language patterns of individuals with ASD.

In Kato et al.'s study[43], the corpus was specifically designed to focus on lexicogrammar. In SFL, lexicogrammar refers to the continuum that combines vocabulary and grammar into one cohesive system, emphasizing their interdependence rather than viewing them as separate strata. This integration is crucial because it reflects how language functions in actual use, where choices in vocabulary (lexis) inherently shape and are shaped by grammatical structures (syntax). Lexicogrammar operates as the grammar of the lexicon, meaning it explains how vocabulary choices interact with syntactic structures to produce meaning. This view allows for a clearer understanding of how language is employed in various contexts for individuals with ASD, whose pragmatic impairments often manifest through lexical anomalies and atypical grammatical constructions. Specifically, Kato et al.'s corpus annotates both syntax and lexicogrammar to capture these subtle distinctions in ASD language use. Previous studies[45, 46] have noted that one of the most common issues in ASD is skewed lexical choices, often categorized as lexical anomalies. Lexical processing challenges are frequently observed in ASD, affecting how individuals select and organize words to convey meaning. The corpus developed by Kato et al.[43] stands out as it provides the first comprehensive annotation of these patterns, aiming to better understand the cognitive underpinnings of these linguistic choices. This detailed approach is critical for furthering the understanding of PI in ASD, offering insights into how lexicogrammatical choices reflect underlying cognitive differences.

Utilizing the corpus from Kato et al.[43, 47], it was observed that Japanese individuals with ASD exhibit a reduced use of sentence-final particles (SFPs), particularly *ne* and *yo*, which are critical for facilitating calls-for-attention in social interactions[43, 47]. These particles serve as verbal indicators of joint attention (JA), a crucial aspect of social cognition. This reduced usage suggests potential impairments in JA and weak central coherence, which are common in ASD. Research shows that typically developing (TD) children begin to use SFPs like *ne* and *yo* between 1.5 and 2 years of age[48–50]. However, Japanese children with ASD demonstrate a marked reduction in their use of these particles[51, 52]. Watamaki[52] links the SFP *ne* to the development of empathy, suggesting that the limited use of *ne* in children with ASD could reflect their social communication impairments. This perspective is further supported by more recent studies[53–55]. Moreover, individuals with ASD also show less frequent usage of evaluative lexis, further indicating problems with JA and weak central coherence[56]. These findings suggest that specific language markers, like the use of SFPs, could potentially serve as diagnostic indicators for ASD. Despite this, no studies have yet conclusively explored whether such linguistic patterns could be reliably applied in ASD diagnosis.

Given that the corpus contains 147 annotated tags, some of which show significant differences between AS and non-AS individuals, it is hypothesized that AS differentiation can be effectively achieved through the use of these tags. In Kato et al.[57], machine learning techniques were used to analyze lexicogrammatical choices in both interview and story-recounting tasks, leading to the development of two diagnostic models: one based solely on annotated linguistic tags and the other combining these tags with textual analysis. The combined model demonstrated strong diagnostic performance, achieving an accuracy of 80%, precision of 82%, sensitivity of 73%, and specificity of 87%.

The objective of this study is to analyze significant differences in lexicogrammatical choices between individuals with ASD and non-ASD individuals from a cognitive perspective, exploring how these differences may reflect underlying cognitive dysfunctions. Prior research suggests that

PI in ASD often manifest as skewed lexical choices, referred to as lexical anomalies[45, 46], and lexical processing issues are frequently cited as semantic challenges in ASD. This study specifically examines Process Types within the TRANSITIVITY system, selected from 157 annotation items, with significant disparities identified by a t-test. These disparities are analyzed to understand their cognitive foundations, emphasizing the connection between cognitive processes and lexicogrammatical choices.

The study acknowledges that variations in lexicogrammatical choices do not always equate to PIs; rather, socially inappropriate lexicogrammatical selections are central to PIs. A qualitative analysis, considering the context of each speech instance, is required to define these differences as indicators of PIs. Here, these lexicogrammatical differences are viewed as characteristic of ASD. When linked to cognitive dysfunctions, they reveal specific cognitive profiles associated with ASD. By connecting cognitive functions to linguistic patterns, the study demonstrates how distinct lexicogrammatical choices among individuals with ASD provide insights into their cognitive profiles, contributing to the understanding of how cognitive dysfunctions are manifested through language.

2. Method

2.1. Choice of Corpus Individuals

From the corpus of spoken language developed by Kato et al.[43], two groups were selected for analysis: individuals with ASD (N = 54, mean age = 20, SD = 6.83) and non-ASD individuals (N = 70, mean age = 21, SD = 6.72), aged 15 years and older, primarily between the ages of 15 to 20. The decision to focus on participants beyond the critical period for language acquisition is based on the Critical Period Hypothesis (CPH), proposed by Lenneberg[58] and Newport[59], which suggests that the optimal time frame for language acquisition closes around puberty. By selecting individuals post-critical period, the study aims to examine lexicogrammatical choices in ASD without the confounding factor of active language development. This allows the research to isolate patterns of language use that may reflect underlying cognitive characteristics specific to ASD.

While the CPH remains debated, various studies support[60–67], oppose[68–70], or hold neutral views[71–73]. The consensus does not lean heavily toward any particular stance. The acceptance of the hypothesis largely depends on the language function being studied (syntax, phonology, morphology) and the language learning context (first or second language). This study adopts a pro-CPH stance to minimize variability in ongoing language development by focusing on individuals aged 15 and older. This aligns with research suggesting that post-puberty language acquisition stabilizes, creating a more reliable baseline for studying ASD-specific linguistic patterns. This approach centers on understanding the underutilization and overutilization of lexicogrammatical resources in individuals with ASD, separate from general language development variability.

Acknowledging that language acquisition evolves throughout life, this study focuses on specific lexicogrammatical resources that appear to be significantly underutilized or overutilized by individuals with ASD. These patterns of usage remain consistent across age groups, pointing to underlying cognitive factors that persist beyond typical developmental stages.

Participants with ASD were clinically diagnosed based on DSM-5 criteria by experienced clinicians specializing in neurodevelopmental disorders. The Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), was used as the primary diagnostic tool, targeting social communication behaviors. Other assessments used for comprehensive evaluation included the SRS-2 for social behavior, intelligence tests (WISC-IV, WAIS-III/IV depending on age), the Vineland-II for adaptive functioning, and parent interviews focused on ASD-related traits (PARS-TR).This ensures a detailed and accurate diagnosis, laying the foundation for understanding language use and cognitive profiles in ASD.

The non-ASD group comprised two distinct participant types: (1) A group of participants (N = 17) who, after comprehensive diagnostic procedures, did not meet criteria for any psychiatric disorder, including neurodevelopmental disorders. These participants underwent the same detailed diagnostic assessments as those in the ASD group, and their results confirmed the absence of clinical diagnoses. (2) A second group primarily composed of college students (N = 53) who were recruited as non-ASD participants. This recruitment was based on ADOS-2 evaluations by a trained administrator, confirming no ASD traits with scores averaging 2.59 in Module 3 and 4.25 in Module 4 for communication

and social interaction, placing them within the non-spectrum category according to ADOS-2 guidelines. Though IQ tests were not utilized, the participants were chosen based on a GPA range of 2.4 to 2.8, which is statistically representative of average Japanese college students[74], who tend to demonstrate strong social adaptability and participation in academic and extracurricular activities. This selection approach specifically targeted social adaptability, aligning with the study's broader objective to contrast social capabilities between ASD and non-ASD groups.

2.2. Ethics Statement

This study was conducted in full compliance with the ethical principles of the Declaration of Helsinki. The research protocol received approval from the Hirosaki University Committee on Medical Ethics, with the initial approval under IRB number 2013-142, and updates resulting in the current approval under 2018-168 (previously 2015-055). Following the committee's information security regulations, personal data protection measures were implemented. For participants aged 20 and older, written informed consent was obtained. For those under the age of 19, consent was collected from both the participants and their parents or guardians. Alphanumeric codes were used to anonymize participants, and any personally identifiable utterances were removed from the transcripts to ensure privacy. The recruitment process and retrospective analysis of diagnostic data were conducted concurrently, both handled with the same ethical care and attention to privacy as detailed above.

2.3. Texts

The ADOS-2 categorizes assessments into five modules based on the participant's age and language proficiency. Modules 3 and 4, which focus on adolescents and adults with fluent speech abilities comparable to that of a typical 4-year-old child, assess a wide range of verbal abilities, including sentence production and logical reasoning, albeit with potential grammatical inaccuracies[75]. Module 3 is designed for verbally fluent children and adolescents, incorporating play-based tasks, while Module 4 focuses on older adolescents and adults, excluding play activities.

For the study, interview texts from Modules 3 and 4 were analyzed. These interviews assess participants' insights into their personal challenges, social responsibility, and understanding of social dynamics, such as friendships, marriage, and family ties. The interview approach avoids a rigid question-answer format, instead promoting conversational engagement by responding to participant statements and facilitating further interaction. All specified questions from the ADOS-2 manual were used to maintain consistency in the assessment process.

2.4. Development of the Annotation Scheme and T-Test Procedure

To develop the annotation scheme, Kato et al.[43] constructed four system networks (representing lexicogrammatical choices made by speakers) based on the theoretical framework of SFL. A key concept in SFL is that language is organized around choice, with speakers selecting expressions depending on factors such as the person they are addressing, the social setting, and other contextual elements. As speakers construct clauses to express meaning, they have numerous options, and they make selections for each part of the clause through a process known as resource-selection mapping. This system network encompasses the full range of lexicogrammatical options available to a speaker in a given situation. In this context, language is understood as a system for creating meaning, with speakers drawing from the system network to navigate social interactions[76]. The system network represents the spectrum of linguistic options, enabling speakers to make choices that effectively convey their intended meanings within a specific context.

To illustrate the lexicogrammatical choices made by individuals with ASD, consider the following responses to the question: What makes you feel relaxed or content?

Example 1 (Declarative): I feel calm when I'm in nature.
Example 2 (Interrogative with modalization: ability, can): Can spending time in nature help you relax?
Example 3 (Declarative with modulation: obligation, must): You must spend more time in nature to feel relaxed.

These examples demonstrate how similar ideas can be conveyed through different lexicogrammatical choices. The mood selection network (**Figure 1**) in the MOOD system is used to analyze these sentences. As the network progresses from left to right, the degree of delicacy increases. In Exam-

ple 1, the declarative mood from the INDICATIVE TYPE is chosen, without the addition of modal elements. The participant provides a direct sentence, clearly stating an experience without ambiguity or the need for interpretation. In Example 2, the interrogative form is selected with modalization (ability, can), where the speaker is likely seeking confirmation or feedback, asking if nature promotes relaxation, thereby encouraging interaction and validation from the listener. In Example 3, modulation (obligation, must) is applied, transforming a declarative sentence into one of necessity. Here, the speaker underscores the importance of nature for relaxation, aiming to influence or persuade the listener. These examples highlight how participants express similar ideas with varying levels of delicacy in their lexicogrammatical choices, illustrating the fundamental role of such selections in communication.

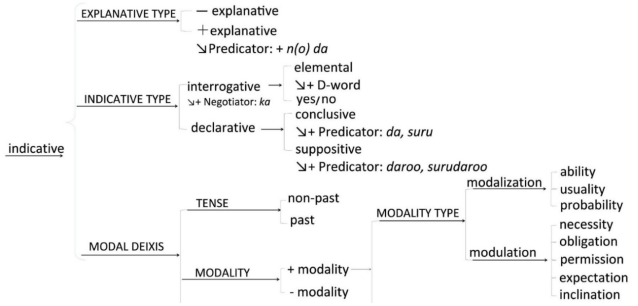

Figure 1. Indicative sentence type from the system network, highlighting the progression of mood selection choices in the MOOD system. It demonstrates the increasing complexity of mood selection choices as they move from left to right within the network [43].

In devising the annotation scheme, Kato et al. [43] constructed four system networks—MOOD, APPRAISAL, TRANSITIVITY (**Figure 2**), and LOGICAL. These networks represent the lexicogrammatical options available to speakers. From these networks, 157 items were selected for annotation within the corpus. Considering the neurocognitive traits typically associated with individuals with ASD, the goal was to identify lexicogrammatical selections that were used either more or less frequently by this group compared to non-ASD individuals. Each lexicogrammatical feature is believed to require specific cognitive abilities for effective use, similar to the cognitive skills needed for JA in using sentence-final particles (SFPs) discussed earlier. This study focuses on the Transitivity system network as part of this broader analysis.

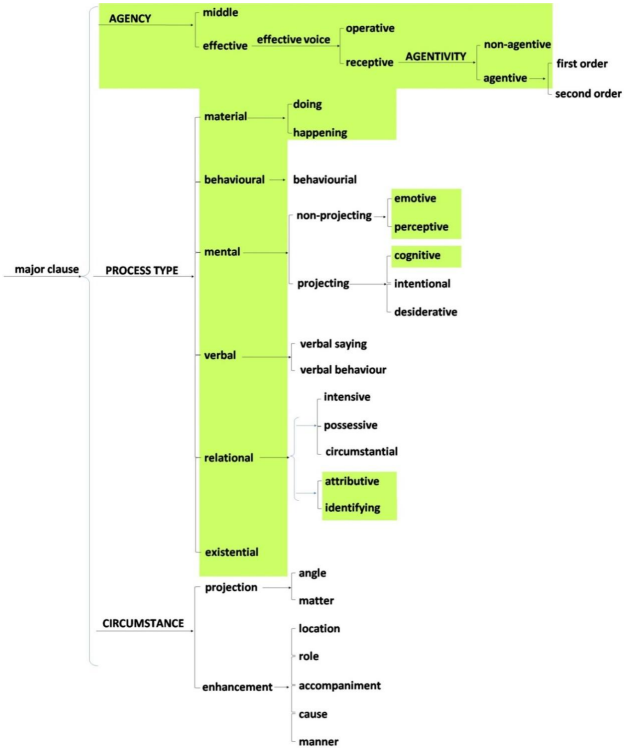

Figure 2. System network of TRANSITIVITY in Japanese [43]. This was constructed by transfer comparison following Matthiessen [77]. TRANSITIVITY deals with components of the clause. The current annotation scheme incorporated the items in the green-colored portions.

2.5. Process Types from SFL Theoretical Framework

The clause plays a critical role in language by enabling the representation of experience, a function referred to as the experiential function in SFL. This function is distinct from the interpersonal function, which focuses on the exchange of information between speakers and listeners. Through the experiential function, language facilitates the construction of mental representations of reality, aiding individuals in understanding both their external environment and their internal thoughts. The TRANSITIVITY system, as conceptualized by Halliday and Matthiessen [78], serves as a linguistic framework that organizes human experiences into distinct Process types, each reflecting different aspects of interaction with the world (**Figure 3**). This system is essential for understanding how language categorizes and represents various experiences. It structures these experiences into semantic configurations consisting of Processes, participants, and circumstantial elements, collectively known as TRANSITIVITY.

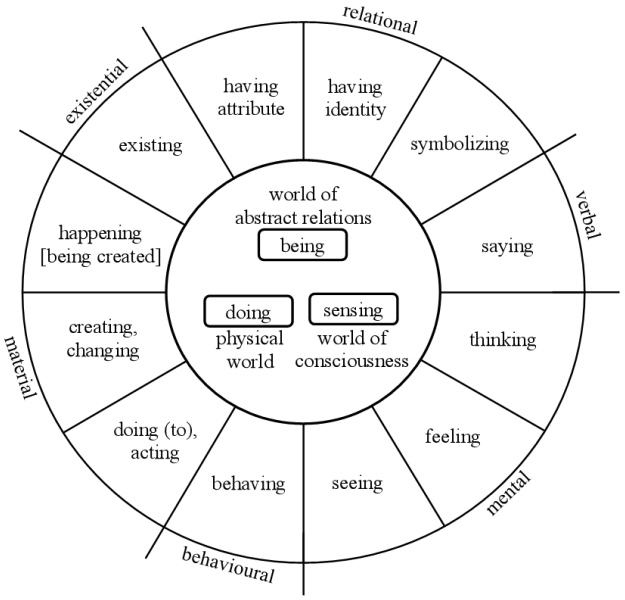

Figure 3. Processes and the reality a human being creates [78].

The main Process types—Material, Mental, and Relational—each offer a specific means of representing aspects of reality. Material Processes are concerned with actions and events, Mental Processes with thoughts and feelings, and Relational Processes with states of being and relationships. These primary categories are supplemented by additional Processes that merge characteristics of the main types, illustrating the complexity of human experiences. These supplementary Processes address expressions of internal states, communication dynamics, and the recognition of existence.

By delineating these Process types within the TRANSITIVITY system, language serves not only as a medium for communication but also as a mechanism for representing and structuring the ongoing flow of human experiences. Understanding the interplay of these Processes provides comprehensive insight into how language shapes our conceptualization of reality, encompassing both observable phenomena and the subjective experiences of individuals. Examples of these Process types are as follows:

(1) **Material Processes**: involve physical actions and events, focusing on actors performing actions or causing events to occur. These Processes represent tangible activities in the external environment and can be categorized into two subtypes: *happening* and *doing*.

happening type:

Example 4: *Garasu* (Actor)-*ga wareta* (Process: happening)

glass-TOP broke AST

The glass broke.

doing type:

Example 5: *Kanojo* (Actor)-*wa doa* (Goal)-*wo aketa* (Process: doing)

she-TOP door-ACC opened-AST

She opened the door.

(2) **Mental Processes**: relate to the internal realm of consciousness, including thoughts, feelings, and perceptions. Mental Processes encode meanings associated with thinking or feeling and are categorized into three sub-types: *thinking, feeling, and seeing*.

thinking type:

Example 6: *Watashi* (Sensor)-*wa sono hanashi-ga hontou-da (Phenomenon) to shinjiteru* (Process: thinking)

I-TOP that story-TOP true-PROJ believe-AST

I believe the story is true.

feeling type:

Example 7: *Kanojo* (Sensor)-*wa atarashii dezain* (Phenomenon)-*ga suki-da* (Process: feeling)

she-TOP new design-ACC like-AST

She likes the new design.

seeing type:

Example 8: *Kare* (Sensor)-*wa tori-ga tobu* (Phenomenon)-*no-wo mita* (Process: seeing)

he-TOP bird-ACC fly saw-AST

He saw the bird fly away.

(3) **Relational Processes**: These Processes define relationships and states of being, involving classification or identification of attributes and situations. Relational Processes express various aspects of *being*, *having*, and *being at*, and are divided into two sub-types: *attributive*, which assigns qualities or attributes to entities, and *identifying*, which establishes identity or equivalence between entities.

attributive type:

Example 9: *Kono hon* (Carrier)-*wa omoshiroi* (Attribute) (Process: attributive)

this book-TOP interesting-AST

This book is interesting.

Example 10: *Kare* (Carrier)-*wa takusan fudousan-ga aru*

he-TOP a lot of real estate-ACC owns-AST

he owns a lot of real estate.

identifying type:

Example 11: *Kore* (Token)-*ga omona mondai-da* (Value) (Process: identifying)

this-TOP main issue-AST

This is the main issue.

(4) **Behavioral Processes**: These actions reflect internal states and occupy the space between Material and Mental Processes, indicating outward behavior influenced by internal emotions. Behavioral Processes involve physiological or psychological behaviors, bridging the gap between Material and Mental Processes by demonstrating how internal experiences manifest as observable actions.

Example 12: *Aka-chan* (Behaver)-*wa naite iru* (Process: Behavioral)

the baby-TOP is crying-AST

The baby is crying.

(5) **Verbal Processes**: These Processes, situated between Mental and Relational Processes, involve using language to articulate thoughts or convey relationships, expressing symbolic interactions. Verbal Processes capture how language is employed to reflect Mental states or relational dynamics, facilitating the expression of thoughts, statements, or exchanges about relationships.

Example 13: *Kanojo* (Sayer)-*wa kaigi* (Verbiage)-*ga shogo-ni aru-to itta* (Process: Verbal)

she-TOP the meeting-TOP noon there is-PROJ said-AST

She said the meeting was at noon.

(6) **Existential Processes**: These Processes acknowledge the existence or presence of phenomena, positioned at the intersection of Relational and Material Processes. Existential clauses express the state of being or existing in a specific location to indicate presence without implying action or emotion. Existential Processes serve to posit that something was or is, emphasizing mere existence rather than describing active involvement or internal states. The primary distinction lies in the *animacy* of the Existent. If the Existent is animate, the Process is expressed by the verb *iru* (be). In contrast, if the Existent is inanimate, the Process is expressed by the verb *aru* (be).

Example 14: *Tsukue-no ueni hon* (Existent)-*ga aru* (Process: Existential:inanimate)

on the desk-LOC book there is-AST

There is a book on the table.

Example 15: *Isu-no ue-ni neko* (Existent) -*ga iru* (Process:Existential:animate)

on the chair cat there is-AST

There is a cat on the chair.

This framework, by categorizing experiences into types of Processes, provides a structured way to analyze how language not only reflects but also constructs our perception of reality. It underscores the grammar's role as a tool for imposing order on the continuous and varied flow of events, thereby shaping our interaction with and understanding of the world.

A t-test was conducted on the 10 annotated items related to Process types to identify significant differences in their usage between individuals with ASD and those without. Items showing statistically significant differences were further analyzed in relation to the cognitive functions associated with ASD.

3. Results

Table 1 presents the t-test results for different Process types, indicating significant differences in the use of Existential Processes (EP) between the ASD and non-ASD groups.

In Japanese, possession and existence are often expressed using the same verb forms, a distinction not commonly found in many Western languages like English, which separate these functions into BE-type and HAVE-type verbs. The Japanese verb *iru* (exist: animate) *aru* (exist: ianimate) is used both to represent existence and to indicate possession [79]. For example, *aru* and *iru* can convey various relationships: (1) inherent ownership, (2) human relationships such as kinship, (3) part-whole relationships including body parts, and (4) spatial relationships [80]. In Japanese, the first three are typically conceptualized as possession, while the fourth is understood as existence [81]. In Japanese, possession and existence sentences may appear to have the same form on the surface, but their syntactic structures are different. In Japanese, relationships (1), (2), and (3) are conceptualized as possession, expressed as *X has Y*, while relationship (4) is conceptualized as existence, expressed as *Y is at X*. These correspond to transitive (possession) and intransitive (existence) sentences, respectively [81].

In contrast, in English, the verb *have* is commonly used to express (1)–(3) and can also imply existence in some contexts, such as "we have much snow in Japan." This demonstrates the close relationship between HAVE and BE verbs in indicating presence [82]. Although *hav*e can also be used

Table 1. Normalized statistical differences in the selection of lexicogrammatical resources between ASD and non-ASD groups in interview texts.

	ASD				Non-ASD				t-Value	p-Value
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.		
Total tokens	2349.164	1237.979	381.000	5835.000	1608.804	913.062	285.000	4622.000	3.670	0.000
Total types	413.639	123.799	182.000	663.000	308.232	103.652	101.000	568.000	4.965	0.000
Sentences Total	154.721	80.562	58.000	363.000	131.821	58.147	43.000	322.000	1.758	0.082
MLU	15.445	4.337	4.950	31.270	12.527	5.445	3.800	31.580	3.160	0.002
Lexical density	5.550	1.483	2.220	10.460	4.618	2.000	1.510	11.720	2.818	0.006
Process Type/Material-doing	0.031	0.007	0.012	0.049	0.031	0.009	0.014	0.051	−0.060	0.952
Process Type/Material-happening	0.005	0.002	0.000	0.011	0.005	0.002	0.000	0.013	−0.298	0.766
Process Type/Mental-thinking	0.018	0.006	0.010	0.040	0.019	0.011	0.005	0.062	−0.883	0.380
Process Type/Mental-feeling	0.018	0.006	0.008	0.036	0.017	0.007	0.003	0.036	0.656	0.513
Process Type/Mental-seeing	0.001	0.001	0.000	0.003	0.001	0.001	0.000	0.007	0.026	0.979
Process Type/Relational-attributive	0.033	0.007	0.016	0.060	0.030	0.008	0.013	0.047	1.847	0.067
Process Type/Relational-identifying	0.013	0.005	0.005	0.030	0.011	0.008	0.002	0.045	0.970	0.335
Process Type/Behavioral	0.004	0.003	0.000	0.019	0.004	0.002	0.000	0.012	0.116	0.908
Process Type/Verbal	0.011	0.004	0.003	0.026	0.010	0.004	0.001	0.020	1.394	0.166
Process Type/Existential	0.014	0.004	0.006	0.026	0.022	0.010	0.006	0.046	−5.478	0.000

for these relationships in Japanese, its usage often feels unnatural compared to the more prevalent use of *aru* and *iru*, especially in existential contexts.

EP typically feature the verb be, making them similar to Relational Processes. However, the verbs commonly found in EP can vary significantly from those used in attributive or identifying Relational Processes. Some verbs in Existential clauses denote *exist* or *happen*, such as *exist, remain, arise, occur, come about, happen*, and *take place*. Others reflect circumstantial features, such as time (*follow, ensue*) or place (*sit, stand, lie; hang, rise, stretch, emerge, grow*). Additionally, more abstract verbs, such as *erupt, flourish, and prevail*, can also indicate a state of being or occurrence. However, this study found that 74 of the expressions of EP were represented by *aru* and *iru* (**Figure 4**).

In this study, significant differences were found in the use of EP between individuals with ASD and those without. The use of Existential expressions, particularly those representing spatial relationships, was notably higher among individuals with ASD. This study classifies *aru* and *iru* when used to represent possession as part of Relational Processes under the category of attributive type.

From a linguistic typology perspective, while frequent use of EP is a characteristic feature of Japanese, the significantly higher usage among individuals with ASD suggests that specific cognitive features may predispose them to favor EP. This inclination may reflect underlying cognitive differences in how individuals with ASD perceive and interact with their environment, leading to a preference for explicitly acknowledging existence rather than articulating possession or relational dynamics.

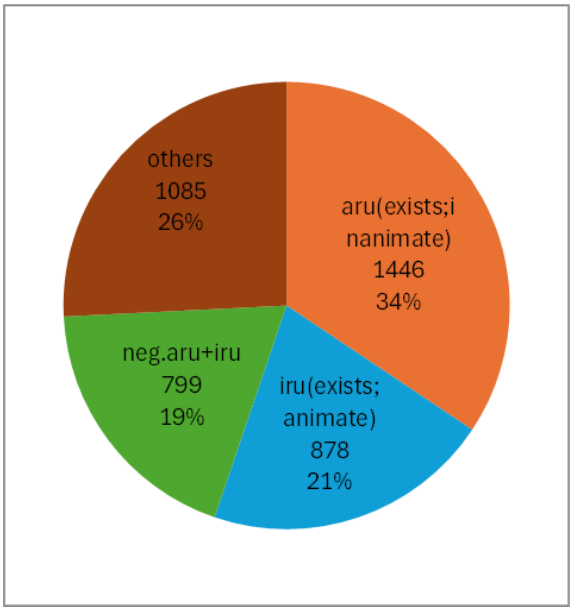

Figure 4. Proportion of Existential Clause Usage Among ASD Individuals.

4. Discussion

The findings of this study, which reveal differences in the use of EP between ASD and non-ASD groups, are interpreted through the framework of cognitive dysfunctions associated with ASD, particularly in relation to self-other awareness. The discussion is structured around the key concepts of self-other differentiation and the sense of agency (SoA), both of which are integral to understanding the cog-

nitive profiles in ASD individuals.

4.1. Ecological Self and Interpersonal Self as Binary Relation

Neisser[83] proposed a model outlining five distinct types of self-knowledge, each reflecting different aspects of how individuals perceive themselves in relation to the world and others: the ecological self, interpersonal self, extended self, private self, and conceptual self. This study specifically focuses on the ecological self and the interpersonal self. The ecological self is the most basic form of self, derived from sensory perceptions and interactions with the environment, characterized by an awareness of one's physical position and movements. It is the self as directly perceived through environmental interaction. In contrast, the interpersonal self emerges from social interactions and emotional exchanges, reflecting self-awareness within relationships and social networks. The interpersonal self is grounded in social interactions and identified through emotional connections, such as eye contact and physical touch, and is also directly perceived.

The ecological self can be explained as the aspect of self-awareness that emerges from one's direct perception and interaction with the environment. It involves understanding oneself as a physical entity in the surrounding world, influenced by the immediate physical and social context. This concept emphasizes how individuals perceive their own existence and activities in relation to the physical world around them. In exploring the concept of the ecological self, one might consider it akin to an individual navigating through a dark room. In this scenario, the person relies solely on tactile sensations, auditory cues, and spatial awareness to move and interact with the environment. Without visual confirmation, the individual must depend entirely on the other senses to understand their position and movement within the space. This process illustrates the ecological self by demonstrating how direct physical interactions with the environment contribute to self-perception, without any visual representation of oneself. This example demonstrates how individuals develop self-awareness rooted in sensory inputs, showing how environments and interactions shape our understanding of ourselves within the world. The ecological self reflects how our perception of changes in the environment informs our sense of self.

In contrast, the interpersonal self refers to the aspect of self-awareness that develops through social interactions and relationships. It involves understanding oneself as a social entity, recognizing the impact of one's actions and emotions on others, and responding to social cues. To illustrate the interpersonal self, consider the dynamic between a caregiver and an infant. From the earliest days, an infant responds to a caregiver's smiles, vocal tones, and touches, developing an initial understanding of relational dynamics. These early interactions are vital as they lay the groundwork for the infant's ability to later navigate more complex social relationships. For example, when a caregiver consistently responds to an infant's needs, the child learns to trust and feel secure in social settings, recognizing the reciprocal nature of human interactions. This foundational stage is crucial for the infant to start perceiving themselves as part of a social world, where their actions elicit responses from those around them.

This interaction exemplify the *primary intersubjectivity* that characterizes early interpersonal engagements, forming the foundation for more complex social interactions as one matures. Such interactions are not just exchanges of information but are foundational to developing empathetic relationships, grounded in the physical and emotional engagements that precede language-based communication. As individuals advance through different life stages, their social landscapes grow more complex, and the emotional connections within these relationships may become less visible. Yet, the self-perception that emerges from these intricate social networks remains rooted in the interpersonal self, shaped fundamentally by these foundational interactions[84].

Both the ecological self and the interpersonal self are understood within the context of a *binary relation*. The ecological self involves the relationship between the self and the physical environment, while the interpersonal self is based on the interactions between the self and other people. In early infancy, these relationships operate separately. For example, a young child may show a strong attachment to a familiar object, like a blanket or toy, and pay little attention to the people around them. Conversely, the child may focus on interacting with caregivers and ignore the objects in their immediate surroundings.

As children grow, around nine to twelve months of age, these separate relationships start to integrate, leading to the development of a more complex *ternary relation*. This inte-

gration involves the self, others, and objects simultaneously, establishing JA. In this stage, an infant might follow a caregiver's gaze toward an object or gesture toward something to capture the caregiver's attention, thus interacting with objects through social engagement with others and understanding that others might do the same. This process reflects the evolving ability to share attention and intention with others, a foundational skill in social and cognitive development.

4.2. Self-Other Differentiation and Agency Awareness in ASD

Developmentally, the discussion in 4.1 describes the typical process for TD individuals. While transitioning from binary to ternary relationships is typical for TD individuals, it can be challenging for individuals with ASD. Here, a brief discussion of the concept of JA is necessary.

JA refers to the social-cognitive skill that enables individuals to both follow and direct the attention of others. In the context of affordances, JA is defined as "the awareness that oneself and another agent are jointly focused on the same ecological entity, and that this shared focus is mutually recognized or understood as common knowledge among the agents"[85]. JA is a foundational cognitive ability that supports daily interpersonal interactions and communication[86].

From a neurocognitive psychology perspective, individuals with ASD often show deficiencies in JA, marked by a lack of behaviors such as gaze-following, pointing, and showing objects to others. These challenges are primarily due to initial difficulties in engaging in interpersonal interactions. Key behavioral indicators include difficulties not only in triadic exchanges (e.g., child-other-object interactions like pointing and gaze-following) but also in face-to-face interactions, mutual gaze, and consistent patterns of social behavior[87]. The fundamental issue is that children with ASD struggle to engage in affective and intersubjective experiences with others, which prevents them from perceiving the intentionality behind others' actions and relating to events as shared experiences[87].

JA is closely linked to children's social motivation[88]. Children who are more socially oriented have more opportunities to acquire social communication skills by observing and participating in interactions. This orientation manifests as a preference for social stimuli, such as voices and faces, over non-social stimuli[89]. However, children with ASD typically do not exhibit this preference for social stimuli and often use different visual scanning patterns and interpret emotions differently than TD children[90, 91]. Research indicates that social motivational deficits in individuals with ASD contribute to persistent JA challenges that can continue into adolescence and adulthood. These deficits, marked by reduced social orientation, lead to diminished interest in social engagement. As a result, individuals with ASD have fewer opportunities to learn social skills, understand social norms, and adopt social roles. This lack of social learning is a key factor in the cognitive dysfunctions associated with JA observed in ASD.

Self-other differentiation forms the foundational basis for developing JA. Children with ASD often show impaired development of self-awareness, particularly in recognizing the separate existence of others[92, 93]. This delay may be associated with attentional abnormalities such as tunnel vision or monotropic thinking, which limit the ability to simultaneously process information about oneself and others[94, 95]. These findings suggest a foundational issue in self-other differentiation, which is crucial for developing self-awareness. Neuroimaging studies have demonstrated that in neurotypical individuals, the middle cingulate cortex and ventromedial prefrontal cortex are actively involved in processing self and other distinctions. In contrast, individuals with ASD show atypical neural responses in these regions, such as diminished activity in the cingulate cortex when attributing actions to themselves, which points to impaired self-responses[96].

These neurological differences may account for the difficulties individuals with ASD face in higher-order self-awareness tasks, particularly those requiring the integration of one's actions with social contexts. While basic self-awareness related to physical navigation and spatial relationships–the ecological self–is generally intact in individuals with ASD, impairments become evident when tasks require combining this ecological self-awareness with social or emotional contexts. For instance, studies have shown that although individuals with ASD can attribute actions to others, their ability to reflect on their own actions is compromised, correlating with the severity of behavioral symptoms[96]. This indicates that even when basic bodily awareness is present, the capacity to understand one's impact on others or recognize the social implications of one's actions may be limited.

Further supporting this perspective, research has identified atypical neural activity in the middle cingulate cortex during self-referential tasks in individuals with ASD, which has been linked to early social impairments [97]. Additionally, studies have noted reduced functional connectivity between the ventromedial prefrontal cortex and somatosensory regions, underscoring difficulties in integrating self-representation and sensory feedback [97]. This reduced connectivity suggests that the pathways that facilitate the understanding of self in relation to others are less developed or functioning differently in individuals with ASD, affecting their ability to form a cohesive sense of agency (SoA). SoA refers to the feeling of initiating and controlling one's actions, thus effecting desired changes in the external world through these actions [98]. Furthermore, the involvement of specific neural areas such as the right inferior parietal lobe, frontopolar regions, and the SI and SII cortices, which are critical for distinguishing between self and others, points to significant disruptions in these networks in ASD individuals [99–101].

From a developmental perspective, these findings align with observations that individuals with ASD have difficulty engaging in JA, a fundamental social-cognitive ability that involves sharing focus with others on a common object or event. JA is a critical building block for understanding that others have separate perspectives, intentions, and knowledge. Without this foundational skill, the development of *intersubjectivity*—awareness of the shared experiences and mutual knowledge with others—is hindered. This can lead to a fragmented self-concept and challenges in engaging in typical social interactions.

In reconciling these perspectives, it's crucial to distinguish between different levels of self-awareness. The intactness of the ecological self allows individuals with ASD to function effectively in their physical environments. Responses point to deficits in processing more complex social and introspective contexts, which are essential for fully developed self-other differentiation and agency awareness. The interplay between impaired self-awareness, reduced SoA, and challenges in understanding others' perspectives indicates a layered disruption in how individuals with ASD process and relate to their social worlds.

4.3. Body Awareness and SoA

Research on body awareness and the SoA in individuals with ASD reveals a complex interplay of neurological, cognitive, and experiential factors. Some studies suggest that individuals with ASD may have an insecure body image or poorly defined body schema, which could lead to atypical experiences of agency. For instance, Russell [102] argues that a lack of secure body awareness might stem from impaired interactions between oneself and others, resulting in challenges in understanding the body's boundaries and agency. Hypothesis is that deficits in executive function could impair the ability to distinguish self-initiated actions from those initiated by others, affecting the SoA [102]. This aligns with broader research indicating that body awareness develops through experiences of interacting with one's own and others' bodies, suggesting that social interactions play a crucial role in forming a coherent body image and SoA [103, 104].

On the other hand, contrasting evidence provided by Williams and Happè [105] shows that individuals with ASD may still be aware of their agency in certain contexts, such as when monitoring their own actions in structured settings. This indicates that these impairments could be more context-specific, emerging particularly in complex social scenarios that require sophisticated self-other differentiation and social interpretation. This variability points to the importance of task demands and context in assessing the SoA in individuals with ASD.

Neuroimaging studies offer further insights into the neural underpinnings of these phenomena. Research indicates that the right hemisphere, particularly the right posterior parietal lobe and the right temporo-parietal junction, is critically involved in body awareness and the SoA [106–109]. These regions are associated with spatial and bodily awareness and play a role in maintaining a sense of ownership during action execution. Additional evidence from transcranial magnetic stimulation (TMS) studies underscores the significance of these areas in maintaining a coherent sense of one's body, suggesting that disruptions in these neural regions could lead to the atypical experiences of agency observed in some individuals with ASD.

The variability in findings across different studies can be understood by considering several factors. First, the specific contexts in which body awareness and SoA are assessed may lead to different outcomes. For example, individuals with ASD may demonstrate awareness of their agency in structured, controlled environments but may struggle in more dynamic, real-world interactions where the cognitive and so-

cial demands are higher. Second, ASD is a spectrum disorder, meaning there is considerable variability among individuals. Some may have significant impairments in body awareness and SoA due to atypical neural development, while others may have relatively intact cognitive functions. This spectrum nature suggests that findings will vary widely, reflecting the diverse cognitive profiles and neural processing patterns of each individual.

4.4. The Development of Self-Awareness as Reflected in Language Use

In what ways is the development of self-awareness and agency awareness reflected in language use, then? The development of self-awareness is closely linked to language acquisition. Around 18 months of age, children begin to use personal pronouns like *I* and *you*, indicating growing self-other differentiation[110]. Loveland[111] demonstrates that children's ability to understand different perspectives is closely linked to their correct use of first and second-person pronouns. This suggests that mastering pronouns involves more than just a cognitive shift in perspective; it requires the cognitive and social skills to adopt the viewpoints of others. Shifting perspectives necessitates a comprehension of others, which is inherently connected to understanding oneself. Thus, Loveland's findings imply that the use of first-person pronouns is based on an integrated awareness of both self and others.

The ecological self relates to the immediate physical perception of one's existence within an environment. Although the speaker's presence is not visually acknowledged in the ecological self, it is still implicitly perceived. This form of self-awareness is expressed through zero forms or implicit references[84, 112]. In contrast, the use of first-person pronouns involves a shift in perspective where the speaker's presence is explicitly recognized within their field of view. This creates a division between the speaker as both the observer and the observed. In other words, while the ecological self aligns with the speaker being immersed in the situation, the use of first-person pronouns places the speaker at a distance, acknowledging the self from an external viewpoint.

The acquisition of the interpersonal self indicates that adopting the perspective that supports first-person pronouns is not merely a shift in perspective but involves moving to the viewpoint of others, requiring interpersonal and societal understanding. This transition necessitates recognizing and understanding others, which is closely linked to self-awareness. Loveland's findings underscore that the use of first-person pronouns is rooted in self-perception that is complementary to the perception of others[113].

However, in children with ASD, there is substantial evidence of impaired pragmatic language use, such as pronoun reversal errors (*I/me/you*)[92, 104, 114, 115], which point to challenges in differentiating self from others. Peeters et al.[116] suggest that children with ASD may communicate from a third-person perspective due to a non-social basis for self-other categorization, which also affects their ability to attribute mental states and mentalize[117]. Adults with ASD often exhibit similar difficulties with pronoun usage[118]. Historical accounts, such as Hans Asperger referring to himself in the third person, further illustrate this[119]. Inner speech, crucial for self-awareness, is often impaired in ASD[120, 121]. Individuals with ASD may primarily rely on images and actions for their inner experiences rather than inner speech or emotions[122]. Many autistic individuals are visual thinkers, relying heavily on visualization for processing information[123].

fMRI studies[124] have shown that individuals with ASD rely more on visualization to support language comprehension, suggesting cortical underconnectivity leads to poor synchronization between linguistic and imaginal processing. Additionally, an imaging study on daydreaming revealed that autistic individuals seldom daydream about themselves or others, suggesting a distinct way in which self-concept and self-awareness are constructed[125]. Together, these studies underscore the crucial role of integrated cognitive processes in forming a coherent sense of self, underscoring the significant impact of language on self-awareness and personal identity in the context of ASD.

4.5. Ecological Self Reflected in Language

The standpoint of the ecological self can be expressed through various Process types, including Material, Mental, Relational, and EP. However, while other process types such as Material or Mental Processes require an agent (Actor, Sensor, Behaver, Sayer, or Carrier, depending on the Process) to initiate or perceive actions (e.g., someone must act or think), EP do not necessitate an explicit agent. EP simply assert the existence of an entity or state without the need for an agent,

as they often involve a state of being or presence (e.g., There is a book on the table). What does the observed difference, in this study, in the use of EP between individuals with ASD and non-ASD individuals signify?

Loveland's findings[111] suggest that before children acquire first and second-person pronouns, they tend to use language structures that do not require explicit reference to a speaker or actor. This tendency aligns with their use of EP, which do not necessitate specifying a speaker or actor within the language structure. The predominance of EP use in ASD individuals indicates a reliance on language structures that do not require explicit self-representation or interaction, aligning more closely with the ecological self. This reliance underscores a cognitive pattern where the development of complex interpersonal relations is less mature, leading to a preference for language that does not necessitate the explicit involvement of a social actor or the agent.

Mach's self-portrait[126] offers an illustrative case (**Figure 5**). Mach depicted an unusual perspective in his self-portrait, which is portrayed from the viewpoint of his left eye while he reclined on a sofa with his right eye closed. This portrait distinctively captures his own body parts—such as the edge of his eye socket, his nose, and his moustache—framed within the visible parts of his limbs and the surrounding environment. Unlike traditional self-portraits that are typically drawn from an external viewpoint as reflected in a mirror, Mach's representation offers a direct view from within, illustrating his internal perspective. This method significantly deviates from conventional self-portraits by providing an introspective view that merges the internal with the external. The boundaries formed by his body define the visible field, enhancing the observer's understanding of spatial relations and object sizes within the visual context. This depiction not only challenges traditional self-representation but also enriches the observer's perception by emphasizing how environmental interactions are internally experienced.

This represents the visualization of the environment, which, when aligned with the linear morphology of language, results in expressions like 'something exists' or 'there is something,' lining up linearly. This perception emphasizes a reliance on ecological self-awareness, where the recognition of one's presence and actions is mediated through interaction with objects and environmental feedback.

Self-perception also intertwines with the perception of actions and their outcomes. For instance, turning off a light switch results in a room going dark; observing this change allows one to recognize the effect of their action. This instance exemplifies Neisser's concept of ecological self-perception, where self-awareness arises not only from direct sensory feedback but also from interpreting events initiated by the observer, even without a visual representation of the self. This demonstrates that self-perception can be mediated through various forms of environmental interaction, regardless of direct visual self-representation[84].

Figure 5. Mach's self-portrait[126].

The observation that individuals with ASD, aged 15 and older, exhibit significantly higher use of these EP suggests a persistence of ASD-featured neuro-cognitive dysfunctions, such as the impaired development of self-other differentiation and SoA, even into adolescence and adulthood. This conclusion arises from three specific aspects that deserve further examination.

(1) Continued reliance on ecological self: The prevalence of EP in adolescents and adults with ASD suggests that these individuals may continue to rely heavily on a form of self-awareness that aligns with the ecological self. This type of self-awareness focuses on the immediate and observable environment, with less inclination toward integrating one's perspective with that of others. Adolescents and adults with ASD might find comfort in using Existential expressions because these emphasize the existence of objects or entities in space without requiring the social dynamics.

(2) Challenges in perspective-taking: Adolescents

and adults with ASD might continue to exhibit challenges in intersubjective understanding, reflected linguistically in the preference for EP. EP focus on stating the presence or occurrence of entities rather than emphasizing their relationships or interactions, which are critical in social communications. The use of EP may indicate a reduced inclination or ability to consider or represent the perspectives of others, thereby indicating ongoing challenges in achieving social integration and mutual understanding.

(3) Social motivation and agency: The reliance on EP might also be linked to a diminished sense of agency and social motivation. For instance, language that emphasizes *there is* or *there exists* rather than relational dynamics may reflect a cognitive orientation towards perceiving the world in a more detached or observational mode, rather than an interactive one. This could relate to findings that individuals with ASD often exhibit less engagement in spontaneous social interactions, potentially due to reduced social motivation or an impaired sense of personal agency in social settings.

This interpretation supports the view that the use of EP in ASD is not just a linguistic preference but reflects underlying cognitive processes that favor less socially demanding interactions. These cognitive traits are mirrored in the linguistic behavior of individuals with ASD, showing the influence of cognitive development on language use. The preference for EP in ASD aligns with a broader cognitive approach to self-awareness, where individuals may focus more on interacting with the world than on explicit self-references. Similar to Mach's self-portrait, which captures the self through indirect representation, individuals with ASD may express their existence through observable interactions rather than internal reflections. This cognitive orientation explains how ASD affects both cognition and linguistic behavior, emphasizing reliance on environmental and interactional cues for self-awareness. The lack of perspective shift in ASD suggests difficulty in considering alternative viewpoints or imagining unseen aspects of the environment. This focus on the immediate and directly observable is consistent with the observed linguistic patterns in ASD, where EP use reflects an emphasis on concrete experiences over abstract or socially complex perspectives.

Japanese language tends to represent the experiential world by focusing more on the situation rather than explicitly on the speaker. This approach often results in implicit speaker representation, where the language relies on intransitive syntax and zero forms to convey meaning. By not explicitly including the speaker in the narrative, Japanese captures events as they naturally appear from the perspective of those involved, aligning with the concept of the ecological self. As discussed in Section 3, in Japanese, both *iru*, *aru*, and *have* are used to express possession, but using *iru* and *aru* is more common. In contrast, languages like English are more likely to use transitive syntax and first-person pronouns, explicitly including the speaker and shifting perspectives to a more detached, *God's Eye View*, which makes the speaker a visible entity in their own field of view [84, 112].

Even considering the typical Japanese linguistic feature of using implicit references or zero forms for self-representation, the significant differences observed between the TD and ASD groups suggest that individuals with ASD use these forms to a much greater extent than is customary in Japanese. This finding indicates that ASD is associated with distinct cognitive characteristics that affect how self-representation is processed and expressed in language, demonstrating a divergence in cognitive processing that influences linguistic patterns.

5. Limitations of the Study

This research represents an initial phase in demonstrating the feasibility of using a diagnostic instrument to evaluate lexicogrammatical choices. The observed differences are explained from the perspective of the relationship between language and cognition. A key limitation of our study is the small sample size. To rigorously validate the developed algorithm, it will be essential to expand the participant pool. This expansion will require addressing logistical challenges and ensuring a larger, more diverse sample to improve both the validity and generalizability of the results.

6. Conclusions

The study revealed that individuals with ASD exhibit distinct lexicogrammatical patterns, particularly in their frequent use of EP such as *aru* and *iru*. These findings suggest that individuals with ASD tend to perceive the world primarily through the lens of the ecological self, demonstrating a direct and unmediated interaction with their environment. This contrasts with the patterns observed in non-ASD indi-

viduals, reinforcing the developmental divergence in how ASD individuals process and express their relationship with the world.

These key differences in EP usage provide important insights into the cognitive processing of individuals with ASD, underscoring the potential of EP as a diagnostic marker for ASD. The study highlights the significance of these lexicogrammatical choices as reflections of underlying cognitive profiles, emphasizing their role in distinguishing ASD from non-ASD populations.

By analyzing the lexicogrammatical choices of individuals with neurodevelopmental disorders like ASD through a large-scale corpus, this research offers meaningful insights into language use across diverse social contexts. Moreover, this approach contributes to the broader development of pragmatic theory, enhancing our understanding of the relationship between language, cognition, and social functions across various populations.

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Institutional Review Board Statement

This research was conducted from September 2, 2013, to October 5, 2020, in strict adherence to the ethical standards outlined in the Declaration of Helsinki. The study protocol was approved by the Hirosaki University Committee on Medical Ethics under IRB number 2013-142, with subsequent updates leading to the current approval under 2018-168, Previous Number: 2015-055.

Informed Consent Statement

To safeguard personal data, we followed the committee's information security guidelines closely. Participants aged 20 and above provided written consent, and for those 19 and under, we obtained written consent from both the participants and their parents or guardians. We used alphanumeric characters to anonymize participants and removed any identifiable utterances from the transcripts to protect their privacy. The recruitment and the retrospective analysis of diagnostic data occurred simultaneously, with the period spanning from September 2, 2013, to October 5, 2020. This dual approach involved both prospective recruitment of participants and the retrospective examination of their diagnostic data, treated with the same ethical rigor and adherence to privacy standards as outlined above.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. However, the data are not publicly accessible due to privacy and ethical restrictions.

Conflict of Interest

The Author declares that there is no conflict of interests.

Abbreviations for Grammatical Items

ACC	accusative
AST	assertive
PROJ	projection
LOC	locative
TOP	topic

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