Comenius University in Bratislava
Faculty of Mathematics, Physics and Informatics

Toward an Axiomatic System of the Autistic Neurotype

Master's Thesis

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Study Programme: Cognitive Science
Field of Study: Computer Science
Department: Department of Applied Informatics
Supervisor: prof. RNDr. Ľubica Beňušková, PhD.

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ZADANIE ZÁVEREČNEJ PRÁCE

Meno a priezvisko študenta: Bc. Alexandra Dyalee
Študijný program: kognitívna veda (Jednoodborové štúdium, magisterský II. st., denná forma)
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Sekundárny jazyk: slovenský

Názov: Towards an Axiomatic System of the Autistic Neurotype
Návrh axiomatického systému autistického neurotypu

Anotácia: Poruchy autistického spektra (PAS) sú v MKCH-11 zjednotené pod jednotným termínom autizmus, pričom diagnostické úrovne sú určené rozsahom a závažnosťou symptómov. Črty spojené s PAS však možno pozorovať aj u mimoriadne nadaných jedincov, pričom môžu korelovať s výnimočným kognitívnym výkonom. Predkladáme a rozpracúvame hypotézu, že podstata autizmu, z principiálneho hľadiska, spočíva v osobitnom súbore pravidiel charakteristických pre daný kognitívny štýl.

Cieľ: (1) Analyzovať teoretické poznatky o kognitívnych procesoch spojených s autistickým neurotypom a syntetizovať ich do formálneho axiomatického systému, ktorý na abstraktnej úrovni zachytáva základné princípy tohto kognitívneho štýlu v kontraste s neurotypickým. (2) Prispieť k teoretickému diskurzu o autizme prostredníctvom originálnej metaúrovňovej perspektívy.

Literatúra: Happé, F., & Frith, U. (2006). The weak coherence account: Detail-focused cognitive style in autism spectrum disorders. Journal of Autism and Developmental Disorders, 36(1) 5–25.
Assouline, S. G. et al. (2009). Profoundly gifted students with autism spectrum disorders. Gifted Child Quarterly, 53(2) 89–103.
Leisman, G., et al. (2025). Autism spectrum disorder: What do we know and where are we going? Brains, 15(9) 1010.

Vedúci: prof. RNDr. Ľubica Beňušková, PhD.
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Vedúci katedry: doc. RNDr. Tatiana Jajcayová, PhD.

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bez obmedzenia

Dátum zadania: 06.10.2025

Dátum schválenia: 07.10.2025

prof. Ing. Igor Farkaš, Dr.
garant študijného programu

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THESIS ASSIGNMENT

Name and Surname:	Bc. Alexandra Dyalee
Study programme:	Cognitive Science (Single degree study, master II. deg., full time form)
Field of Study:	Computer Science
Type of Thesis:	Diploma Thesis
Language of Thesis:	English
Secondary language:	Slovak

Title: Towards an Axiomatic System of the Autistic Neurotype

Annotation: Autism Spectrum Conditions (ASC) are unified under the single term Autism in the ICD-11, with diagnostic levels specified by the range and severity of symptoms. Traits associated with ASC can also be observed in highly gifted individuals and may correlate with exceptional cognitive performance. We raise and elaborate a hypothesis that the essence of autism, from a principled perspective, may lie in a distinct set of cognitive-style rules.

Aim: (1) Analyse theoretical insights into cognitive processes associated with the autistic neurotype and to synthesize them into a formal axiomatic system that, at an abstract level, captures the fundamental principles of this cognitive style in contrast to the neurotypical one. (2) Contribute to the theoretical discourse on autism by offering a novel meta-level perspective.

Literature: Happé, F., & Frith, U. (2006). The weak coherence account: Detail-focused cognitive style in autism spectrum disorders. Journal of Autism and Developmental Disorders, 36(1) 5–25.
Assouline, S. G. et al. (2009). Profoundly gifted students with autism spectrum disorders. Gifted Child Quarterly, 53(2) 89–103.
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Supervisor:	prof. RNDr. Ľubica Beňušková, PhD.
Department:	FMFI.KAI - Department of Applied Informatics
Head of department:	doc. RNDr. Tatiana Jajcayová, PhD.
Assigned:	06.10.2025
Approved:	07.10.2025

prof. Ing. Igor Farkaš, Dr.
Guarantor of Study Programme

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Student Supervisor

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I would like to express my sincere gratitude to my supervisor, prof. RNDr. Ľubica Beňušková, PhD., for believing in the ambition of this project even during its earliest conceptual stages. I greatly appreciate her guidance and the time she devoted to reviewing the work through multiple challenging iterations until it reached its present form.

I am especially grateful to everyone who treated these ideas with intellectual openness throughout the process and gave me the opportunity to discuss them without premature dismissal solely because of their unconventional nature. Such openness is essential for new theoretical ideas to be explored and developed to their full extent.

Abstract

This thesis develops an axiomatic framework for describing autistic cognition. Rather than treating autism as a diagnostic category, the proposed approach conceptualises it as a computational organisation of cognition that is expected to manifest to varying degrees in individuals. Principles of autistic cognition, contrasted with allistic cognition, are introduced and formalised as an axiomatic system specifying differences in attentional allocation, representational processing, validation, motivation, and cognitive integration. The formal properties of the system are examined through consistency and independence analyses of its first-order formalisation, while its generative capacity is demonstrated by deriving selected theorems and interpreting them psychologically. The results suggest that characteristic cognitive tendencies may emerge from a common underlying structure.

Keywords: autism spectrum conditions, autistic cognition, axiomatic system, applied logic, neurotype, cognitive style

Abstrakt

Táto diplomová práca navrhuje axiomatický systém pre opis autistickej kognície. Namiesto chápania autizmu ako diagnostickej kategórie ho navrhovaný prístup konceptualizuje ako špecifickú organizáciu kognície, ktorá sa môže u jednotlivcov prejavovať v rôznej miere. Princípy autistickej kognície v porovnaní s alistickou kogníciou sú navrhnuté a formalizované vo forme axiomatického systému špecifikujúceho rozdiely v alokácii pozornosti, reprezentačnom spracovaní, validácii, motivácii a kognitívnej integrácii. Formálne vlastnosti systému sú skúmané prostredníctvom analýzy konzistencie a nezávislosti jeho formalizácie v logike prvého rádu, zatiaľ čo jeho generatívna kapacita je demonštrovaná odvodením vybraných viet a ich psychologickou interpretáciou. Výsledky naznačujú, že charakteristické kognitívne tendencie môžu byť dôsledkom spoločnej podkladovej štruktúry.

Kľúčové slová: poruchy autistického spektra, autistická kognícia, axiomatický systém, aplikovaná logika, neurotyp, kognitívny štýl

Contents

Introduction

People with autism spectrum conditions (ASCs) exhibit substantial variability in cognition, behaviour and everyday functioning. Contemporary diagnostic systems, such as the DSM-5-TR and the ICD-11, describe this variability through behavioural criteria and support levels. While these frameworks are useful for clinical identification of autism, they do not directly address the cognitive processes underlying autistic thinking. The cognitive mechanisms underlying this phenotypic diversity remain incompletely understood.

Over the past few decades, several influential theories have attempted to explain aspects of autistic cognition. These include the Weak Central Coherence theory, Predictive Processing accounts, Excitation–Inhibition Imbalance theories and the Intense World Theory. While each of these frameworks captures important features of autistic processing, none has achieved broad consensus as a unified explanatory account. Existing approaches often focus on isolated mechanisms or specific levels of description, providing only a partial answer to the question of the nature of autism.

The present work is motivated by the observation that many descriptions of autistic cognition remain primarily phenomenological despite the substantial phenotypic variability observed across the spectrum. While observable characteristics such as detail-oriented processing, atypical attentional allocation, sensory sensitivity, and autonomous reasoning are frequently described, the underlying structural principles that give rise to them are rarely formalized, nor are they considered in terms of their interaction. Consequently, it remains unclear whether these characteristics represent independent phenomena or arise as consequences of a smaller set of fundamental cognitive principles.

To address this problem, this thesis takes an axiomatic approach. Rather than describing individual manifestations of autistic cognition directly, it seeks to identify a set of abstract principles from which characteristic cognitive tendencies can be derived. Within this framework, autism is not treated as a diagnostic category, but rather as a computational organisation of cognition that can be contrasted with an allistic organisation at a formal level of description. The aim of this thesis is to develop an axiomatic framework for describing autistic cognition. By expressing fundamental assumptions explicitly, the framework enables us to investigate whether characteristic cognitive tendencies can be derived from a common underlying structure.

The thesis proceeds as follows. Chapter 1 reviews current knowledge regarding autism spectrum conditions and discusses major theoretical approaches. Chapter 2 explains and justifies the abstraction of autism from specific clinical diagnoses, as well as the use of an axiomatic framework. Chapter 3 introduces a general cognitive pipeline model and identifies the processing differences expected to distinguish between autistic and neurotypical cognition. Chapter 4 presents the proposed axiomatic system together with its interpretation. Chapter 5 investigates the formal properties of the mathematical system, including consistency, independence and generativity. Finally, Chapter 6 derives selected theorems and discusses their psychological interpretation.

This work contributes a mathematically rigorous theory for describing autistic cognition and exploring how cognitive tendencies, behavioural patterns, and subjective experiences may emerge from a small set of underlying principles.

Chapter 1

Autism Spectrum Conditions

Current State of Knowledge

1.1 Definition

Autism spectrum conditions (ASC), or autism spectrum disorders[1], are neurodevelopmental conditions characterized by systematic differences across multiple cognitive domains. Clinical diagnoses are primarily made according to the presence of *difficulties* in the social domain; however, associated features may also include differences in executive flexibility and information processing, particularly within sensory and affective domains (World Health Organization, 2022; American Psychiatric Association, 2022). According to the extent and configuration of these neurocognitive difficulties, together with an individual's intellectual and communication abilities, specific ASC diagnoses are assigned.

Before proceeding further, it is important to clarify the distinction between neurocognitive *differences* and the *difficulties* that may arise from them. In this thesis, differences are treated as primary characteristics of cognitive organization, while difficulties are understood as context-dependent manifestations that may emerge under particular environmental, social, or normative demands.

In contrast to autistic cognition, *allistic* cognition refers to the statistically predominant neurocognitive profile in the general population. Importantly, traits associated with autistic cognition may also be present in allistic individuals; however, the boundary for clinical diagnosis is primarily enforced within the social domain (see Section 1.1.4). This boundary reflects diagnostic convention rather than a strict categorical separation between cognitive types.

[1]The term *autism spectrum conditions* is often preferred in non-pathologizing contexts; however, *autism spectrum disorder* remains the formal diagnostic designation in DSM-5-TR and ICD-11.

For reference, the currently accepted *operational diagnostic definition* of autism spectrum conditions according to the DSM-5-TR is given below.

Definition. Autism spectrum disorder is defined by two core domains:

- persistent deficits in social communication and social interaction, and
- restricted, repetitive patterns of behavior, interests, or activities.

with:

- early developmental onset,
- clinically significant impairment,
- dimensional severity specifiers (support levels).

It is important to note that the terms *autism*, *autism spectrum conditions*, and *neurodiversity* — the latter often used as a broader umbrella encompassing systematic differences in cognitive processing styles — are relatively recent constructs within scientific and clinical discourse. As a consequence, their conceptual boundaries, taxonomies, and underlying assumptions are still undergoing refinement, and a fully consensual understanding has yet to stabilize.

The phenomenon now referred to as autism was first introduced in 1911 by Eugen Bleuler (Bleuler, 1911). At the time, the term *Autismus* was used to describe a feature of schizophrenia, referring to a detachment from external reality accompanied by a withdrawal into an individual's inner world. This usage was restricted to severe psychiatric pathology, and cognitively intact or developmentally typical cases were not yet conceptualized.

The shift from conceptualizing autism as a form of inner psychotic withdrawal toward understanding it as a distinct, non-psychotic neurodevelopmental condition was not reached until the mid-20th century (Kanner, 1943). During this period, early clinical formulations emphasized profound social withdrawal, atypical communicational development, and an early onset. This clearly distinguished autism from schizophrenia and psychotic-related conditions.

Early after, however, the discussion was challenged by substantial heterogeneity within autistic presentations. This led to the identification of multiple clinical profiles and, later, to the recognition of individuals with preserved or high intellectual and linguistic abilities. One of the earliest indications of such heterogeneity appeared shortly after Kanner's originally described autism, when Hans Asperger reported a group of children who exhibited autistic traits alongside intact intelligence and advanced linguistic skills (Asperger, 1944). This recognition of qualitatively distinct autistic presentations and the later formalization of subtypes both challenged early deficit-centered models, ultimately motivating a reconceptualization of autism from a unitary condition.

The introduction of Asperger syndrome represented a significant attempt to describe a distinct cognitive profile, characterized by preserved language and intelligence alongside some social and communicative differences. Despite the clear categorization, Asperger's syndrome was later removed as a separate diagnostic category. Its removal is a decision that remains the subject of ongoing debate, because while this change aimed to improve diagnostic consistency, it simultaneously raised questions about the adequate representation of cognitive specificity within the spectrum, particularly among higher-functioning individuals (Lord and Jones, 2012).

From a broader perspective, an epistemological youth is reflected in the evolving terminology — the scientific community is still developing models capable of capturing the full structural variability of autistic cognition. This is especially evident in cases where individuals do not primarily present with overt functional impairments but rather with qualitatively distinct modes of perception, reasoning, and social interpretation. Such cases continue to challenge existing diagnostic frameworks and motivate the search for more formalized, structure-oriented descriptions of cognitive neurotypes, rather than purely behavioral models, which may lose substantial information.

1.2 Current state of the art

Contemporary autism research no longer treats autism spectrum conditions as narrowly defined clinical subtypes, but as a highly heterogeneous neurodevelopmental spectrum. In both DSM-5-TR and ICD-11, previously separated diagnostic categories such as autistic disorder, Asperger syndrome, and pervasive developmental disorder not otherwise specified have been replaced by a unified autism spectrum diagnosis (American Psychiatric Association, 2022; World Health Organization, 2022). This change reflects the view that autistic presentations vary dimensionally across multiple domains rather than forming clearly separable clinical kinds (Ousley and Cermak, 2014; Lombardo et al., 2019).

In the current diagnostic framework, autism is primarily defined by two domains (see Section 1.1): persistent differences or deficits in social communication and reciprocal social interaction, and restricted, repetitive, or highly focused patterns of behaviour, interests, or activities. However, the diagnosis is further specified according to accompanying intellectual and language impairments, comorbid conditions, and required levels of support (American Psychiatric Association, 2022; World Health Organization, 2022).

A central feature of the current state of knowledge is therefore **heterogeneity**.

Autistic individuals may differ substantially in domains of language ability, intellectual functioning, sensory processing differences, adaptive functioning, emotional regulation, social motivation, executive functioning, and co-occurring conditions (Lord et al., 2020).

At the same time, **this shift remains debated**, because a single umbrella category may obscure meaningful differences between individuals with very different cognitive, communicative, and support profiles (Lord and Jones, 2012).

Moreover, recent research increasingly emphasizes that autism should not be understood as a single condition with one cause or one developmental pathway. Genetic, developmental, cognitive, and behavioural findings suggest multiple partially overlapping profiles within the autism spectrum rather than a unitary mechanism (Lord et al., 2020; Lombardo et al., 2019). Current models therefore tend to describe autism as a complex neurodevelopmental construct involving interactions between genetic liability, early development, sensory processing, social cognition, environmental demands, and compensatory or camouflaging strategies (Lord et al., 2020; Hull et al., 2017).

This is particularly important for individuals without intellectual disability and language impairments, namely individuals who would historically have received an Asperger syndrome diagnosis (Lord and Jones, 2012). In such cases, visible impairment is often reduced, delayed, or masked, while underlying cognitive and sensory differences remain unchanged (Hull et al., 2017; Livingston et al., 2020). Consequently, contemporary research in autism distinguishes between observable behavior, internal cognitive organization, adaptive functioning, and social-environmental fit (Livingston et al., 2020; Lord et al., 2020).

The current state of the art could thus be summarized as follows: formally, autism is diagnosed through behavioral criteria, but it is increasingly understood as a heterogeneous neurocognitive spectrum whose manifestations depend on multiple factors. This, however, constitutes a methodological gap between diagnostic classification and mechanistic explanation. While DSM-5-TR and ICD-11 provide operational criteria for clinical identification, they do not fully specify the underlying cognitive structure that gives rise to autistic perception, reasoning, attention, social interpretation, or adaptation (Lord et al., 2020; Lombardo et al., 2019).

Despite significant advances in genetics, neuroscience, and cognitive science, no single theoretical framework has yet achieved consensus in explaining the underlying structure of autistic cognition.

This gap motivates the present thesis. If autism is not a discrete behavioral subtype but a spectrum of systematically organized cognitive differences, then a formal model should aim to describe the structure of these differences rather than merely listing their behavioral outcomes.

1.3 Phenotypic variability

A defining characteristic of autism spectrum conditions is the breadth of their phenotypic variability. As mentioned earlier, contemporary diagnostic frameworks use a unified spectrum model, but observable symptoms of autism can vary widely across individuals in terms of cognitive ability, language development, behavioural expression, and adaptive functioning (Lord et al., 2020; Ousley and Cermak, 2014).

In the past, this variability was captured through different diagnostic categories, namely autistic disorder with functional characteristics, Asperger syndrome, atypical autism, and pervasive developmental disorder not otherwise specified. These categories were intended to reflect differences in symptom presentation. However, subsequent research demonstrated that these subtypes were not reliably separable and that significant overlap was often present. This led to their replacement by a spectrum-based conceptualisation (Ousley and Cermak, 2014; Lord and Jones, 2012).

Despite this shift, the underlying phenotypic diversity has not diminished; rather, it is now represented dimensionally within the spectrum. Individuals may differ along multiple axes, including intellectual functioning (ranging from intellectual disability to superior abilities, which are sometimes associated with profiles historically described as Asperger syndrome), language development (from non-verbal to highly articulate), and the degree and form of social and behavioural differences. In addition, sensory processing differences, such as hypersensitivity or hyposensitivity to environmental stimuli, constitute a prominent but highly variable component of the autistic phenotype (Lord et al., 2020).

Another important source of variability arises from co-occurring conditions. These may include neurological conditions such as epilepsy, as well as intellectual variability ranging from intellectual disability to giftedness, but also psychiatric comorbidities, particularly in individuals without intellectual disability, including many females, such as attention-deficit hyperactivity disorder, anxiety disorders, and depression. These comorbid conditions are discussed as significantly influencing an individual's overall presentation and shaping a role in the functional profile (Ousley and Cermak, 2014). As a result, the observable phenotype often reflects not only core autistic characteristics but also the interaction between multiple cognitive, developmental, and environmental factors.

Furthermore, phenotypic expression is subject to changes throughout development. Early childhood autism presentations characterised by more overt behavioural differences may evolve into more subtle symptomatologic profiles in adolescence and adulthood, particularly in individuals with higher cognitive and language abilities and many females. In these cases, adaptive strategies and camouflaging behaviours are believed to be responsible for reduced visibility of autistic traits without altering the underlying cognitive organisation (Hull et al., 2017; Livingston et al., 2020).

1.4 Diagnostic frameworks

The latest diagnostic practice in autism spectrum conditions uses a combination of standardized observational instruments, structured interviews, and clinical confirmation. Importantly, no single instrument is considered sufficient for diagnosis. Diagnostic conclusions depend on integrating multiple sources of information.

The current “gold standard” in assessment involves combining the Autism Diagnostic Observation Schedule (ADOS-2) and the Autism Diagnostic Interview–Revised (ADI-R) (Lebersfeld et al., 2021).

1.4.1 Autism Diagnostic Observation Schedule (ADOS-2)

The Autism Diagnostic Observation Schedule (ADOS-2) is a standardized, semi-structured assessment based on direct observation of social interaction, play, and cognitive patterns associated with autism (Lord et al., 2012).

ADOS-2 is organized into several modules, which are selected according to the individual’s age and language level:

- *Module 1*: for individuals with little or no phrase speech
- *Module 2*: for individuals with phrase speech but not fluent
- *Module 3*: for verbally fluent children and adolescents
- *Module 4*: for verbally fluent adolescents and adults
- *Toddler Module*: for very young children

According to a given module, the examiner codes observed behaviors, which are then converted into algorithm-based scores corresponding to diagnostic thresholds.

Although the ADOS-2 is considered a reliable diagnostic observation tool, it has the limitation of relying primarily on a structured setting to assess behavioral expression. Therefore, factors such as masking or situational variability may hinder the clarity of the assessment (Happé and Frith, 2020).

1.4.2 Autism Diagnostic Interview–Revised (ADI-R)

The Autism Diagnostic Interview–Revised (ADI-R) (Rutter et al., 2003) is a structured interview that assesses developmental history and current behavior with the help of a caregiver across three domains:

- social interaction,
- language and communication, and
- restricted and repetitive behaviors.

ADI-R provides a retrospective developmental perspective that complements the real-time behavioral assessment of ADOS-2. It is particularly valuable for identifying early developmental patterns required for correct diagnosis.

However, its reliance on caregiver reports introduces potential limitations related to memory, interpretation, and the availability of information providers.

1.4.3 Additional instruments and screening tools

Beyond ADOS-2 and ADI-R, there is a range of additional instruments that may be used to support assessment, particularly in screening or differential diagnosis:

- CARS-2 (Childhood Autism Rating Scale) — clinician-rated scale assessing symptom severity
- SRS-2 (Social Responsiveness Scale) — questionnaire measuring autistic traits across given dimensions
- AQ (Autism Spectrum Quotient) — self-report measure often used in adult screening and/or research
- M-CHAT (Modified Checklist for Autism in Toddlers) — an early screening tool for young children

These instruments vary in purpose: some are designed for screening, others for quantifying traits, and others for supporting clinical judgment, but none of them replace a full diagnostic evaluation (National Institute for Health and Care Excellence, 2011).

1.4.4 Criteria frameworks

All tools for assessment operate within broader systems of classification, which primarily include:

- DSM-5-TR (Diagnostic and Statistical Manual of Mental Disorders)
- ICD-11 (International Classification of Disorders)

These frameworks define the formal diagnostic criteria and specify required domains and severity levels. Instruments such as ADOS-2 and ADI-R alone are therefore not diagnostic. They provide structured evidence that is later interpreted within the discussed classificatory systems (American Psychiatric Association, 2022; World Health Organization, 2022).

1.4.5 Limitations of current frameworks

Despite their widespread use, current frameworks used for diagnostics exhibit several limitations:

- they are fundamentally defined behaviorally, which leads to a potential overlook of the underlying cognitive structure (Happé and Frith, 2020),
- they may be easy to fail on individuals who engage in camouflaging or compensation, particularly among females and high-functioning individuals (Hull et al., 2017),
- they rely on context-dependent observations, which may not fully capture everyday functioning (Happé and Frith, 2020), and
- they provide limited insight into mechanistic explanations of autistic cognition (Mottron, 2021).

1.5 Existing cognitive theories

As the cognitive characteristics of autism spectrum conditions remain an active area of research, several theoretical frameworks have been proposed with the aim of explaining them.

1.5.1 Weak Central Coherence

Weak Central Coherence (WCC) is a theoretical framework that proposes that autistic cognition is characterized by a bias toward local processing at the expense of global integration (Frith, 1989).

According to this account, individuals on the autism spectrum tend to prioritize details over contextual information, resulting in a distinctive cognitive style and processing patterns.

From a mechanistic point of view, this account has been interpreted as a relative reduction in the integration of distributed information, leading to heightened sensitivity to local features and diminishing the influence of global structure. Findings that autistic individuals tend to outperform allistic controls on tasks involving detailed visual search, where local processing confers an advantage, confirm this theory empirically (Happe and Frith, 2006).

However, despite its descriptive strength, WCC does not explain why this processing bias arises, nor does it specify the underlying cognitive or neural mechanisms responsible for it. Moreover, it does not constitute a comprehensive cognitive architecture capable of accounting for the full range of autistic cognition. WCC therefore describes a processing style but does not specify underlying mechanisms or formal structure.

1.5.2 Predictive Processing

Predictive processing frameworks conceptualize the brain as a hierarchical prediction machine that continuously generates and updates models of the environment in order to minimize prediction error. Within this framework, perception and cognition are believed to arise from the interaction between prior models (expectations) and incoming sensory input (Clark, 2013).

In the context of autism, this balance is thought to be altered by atypical precision weighting of priors and sensory signals. Specifically, reduced precision of prior expectations or increased precision of sensory input are proposed to diminish the influence of contextual information and lead to a heightened sensitivity to incoming stimuli. Empirical support for this account comes from findings of increased sensory sensitivity and a reduced reliance on contextual cues in perception and decision-making tasks (Pellicano and Burr, 2012; Van de Cruys et al., 2014).

Predictive processing accounts, however, can accommodate a wide range of empirical findings, which makes them difficult to falsify. Furthermore, the framework often lacks a clear and direct mapping onto observable cognitive structures and behaviors at the level required for precise characterization of autistic cognition. While theoretically powerful, predictive accounts often remain underspecified at the level of concrete cognitive organization (Happé and Frith, 2020; Van de Cruys et al., 2014).

1.5.3 Excitation–Inhibition Imbalance

The excitation–inhibition (E/I) imbalance hypothesis proposes that autism spectrum conditions result from an atypical balance between excitatory and inhibitory neuronal activity (Rubenstein and Merzenich, 2003).

It is thought that there is an increase in excitatory signaling and a reduction in inhibitory control. This is thought to result in heightened neural responsiveness and altered signal processing.

From a mechanistic perspective, such an imbalance may lead to increased neural gain or noise, thereby affecting the stability and selectivity of information processing. Sensory hypersensitivity, atypical perceptual processing, and neurophysiological evidence of altered cortical excitation and inhibition support this account empirically (Nelson and Valakh, 2015).

However, despite its biological plausibility, the E/I imbalance approach operates primarily at the neural (cellular) level and does not provide a detailed account of higher-level cognitive organization. It is not fully specified how these neural differences give rise to diverse patterns of perception, attention, or reasoning. Therefore, while the E/I framework offers a potential mechanistic substrate, it remains limited in its ability to explain the higher-level cognitive structure of autistic processing (Happé and Frith, 2020).

1.5.4 Intense World Theory

The Intense World Theory (Markram and Markram, 2010) proposes that autism spectrum conditions are characterized by hyper-reactive and hyper-plastic neural circuits, leading to an amplification of perception, emotional processing, and memory. Autistic individuals are thought to process information at an excessive intensity within this framework, with heightened sensitivity to sensory and affective stimuli.

Mechanistically, this increased neural responsiveness may result in an above-the-threshold influx of information to be processed, which can lead to reduced engagement with complex social environments in turn. Empirical accounts come from findings of sensory hypersensitivity and unusual emotional reactivity present in some individuals on the autism spectrum.

However, despite being intuitively appealing, the Intense World Theory has been criticized for its tendency to overgeneralize across the autism spectrum and for not being consistently supported across all individuals on the spectrum of autism (Happé and Frith, 2020).

Furthermore, it does not provide a formalized account of cognitive structure or specification of how amplified neural responses translate into diverse patterns of behavior and cognition.

1.5.5 Limitations of existing theories

Despite providing valuable insights, existing cognitive theories of autism remain limited in several important respects.

First, they tend to operate within isolated domains of explanation, focusing either on perceptual style, computational principles, neural mechanisms, or subjective experience, without offering a unified account of how these levels interact. As a result, they do not provide a systematic explanation of how local processing characteristics, predictive dynamics, or neural differences jointly give rise to higher-order patterns of autistic cognition.

Second, these theories offer only limited insight into the emergence of meta-cognitive patterns, that is, the structured outcomes of autistic thinking across spectrum-wide domains such as perception, salience allocation, attention, and cognitive or social interpretation. While they successfully describe particular aspects of the processing loop, they do not formalize how these aspects combine into a coherent cognitive profile.

Third, current accounts do not clearly specify the boundary between adaptive cognitive variation and maladaptive functioning. Although autism is currently conceptualized as a spectrum of cognitive differences, existing theories do not specify under what conditions these differences constitute a beneficial cognitive style and under what conditions they lead to functional maladaptation.

Furthermore, these frameworks provide limited sources for an important direct comparison between autistic and allistic cognition. There is no universal formal structure that would allow systematic comparison of processing patterns across neurotypes, as differences have been described so far qualitatively.

Finally, although some theories propose mechanistic explanations, these are either too abstract or too low-level to account for the diversity of observed phenotypes. In particular, they do not fully explain how multiple distinct cognitive and behavioral profiles can arise from what is treated as a single underlying neurotype.

These limitations, taken together, highlight the absence of a multidomain, formally precise description capable of capturing the structure of autistic cognition across processing levels.

Chapter 2

From Spectrum to Cognitive Model

As discussed in Chapter 1, autism spectrum conditions exhibit significant phenotypic variability with diverse observable profiles (Happé and Frith, 2020). These will be treated as arising from the interaction between an underlying neurocognitive structure (autistic and/or allistic) and additional cognitive factors.

Examples of the phenotypic diversity include variations in intellectual functioning, language abilities, and gender-related presentations. Historically, they were classified as Asperger Syndrome, Autistic Disorder (Classic Autism) with varying functioning patterns, Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS), and Rett Syndrome (American Psychiatric Association, 2013).

Contemporary literature categorizes them as ASD Level 1, ASD Level 2, and ASD Level 3, according to support needs (American Psychiatric Association, 2022; World Health Organization, 2022).

In the present work, features that shape the autism typology are treated as modulatory factors influencing observable outcomes rather than as defining components of the underlying neurotype.

The further aim of this chapter will, therefore, be to **abstract the core structural pattern of autistic cognition from its phenotypic manifestations** in order to characterize it independently of these interacting factors and enable systematic comparison with allistic cognition.

2.1 Conceptualizing the autistic neurotype

To develop a formal account of autistic cognition, it is necessary to distinguish between the underlying cognitive structure and the diverse set of interacting factors that shape its observable manifestations. As discussed in the previous chapter, the phenotype associated with autism spectrum conditions arises from the interaction between a neuro-cognitive structure and a range of additional variables, including intellectual functioning, language ability, and environmental context.

From a modeling perspective, these interacting factors produce variability that can introduce noise into the structural properties of the underlying neurotype. Therefore, the present work adopts a controlled-abstraction approach, treating such factors as modulatory influences rather than defining components of the system. This allows for the isolation of the core structural pattern of autistic cognition present across the full phenotypic variability, minimizing the confounding effects of comorbid cognitive influences.

We make a modeling choice that, from an empirical perspective on data collection, one of the closest phenotypic approximations of this principle is Asperger Syndrome with intact intellectual functioning across multiple intellectual domains, preserved language and communication abilities, and a suitable environmental context. To preserve intellectual control over social behavior and the potential for explicit reasoning about social situations, we also consider meta-cognitive abilities to be well developed. This choice is motivated by methodological considerations and is justified in sec:justification.

The goal of this abstraction is not to deny the relevance of comorbidities or individual differences, but to enable a more precise characterization of the cognitive organization that underlies them. By reducing the complexity of interacting influences, it becomes possible to define a formal representation of the autistic neurotype and to compare it systematically with allistic cognition.

In the following sections of this thesis, we will refer to this abstraction as “autism”.

2.2 Scope of description

2.2.1 Model of cognition as a reference

The present work considers the full loop of cognitive processing, beginning with the input of information and extending through interpretation, action, and subsequent learning. This loop serves as a conceptual reference for situating individual cognitive processes within a unified framework.

However, not all components of this loop are explicitly formalized, given the structure of an axiomatic system. Our description focuses on fundamental principles expressed as axioms, which may or may not constitute a subset of the processes described in a loop. From these, later additional cognitive patterns might be derivable in the form of theorems.

Furthermore, cognitive processes that are assumed to be shared between autistic and allistic cognition are not the primary focus of this work and are therefore not explicitly formalized until specifically needed. The aim is to isolate the structural features that differentiate processing patterns while retaining the broader cognitive loop as a guiding reference.

2.2.2 Mathematical description

The framework adopted in this work is an axiomatic system designed to capture key structural differences in autistic cognition in a mathematically explicit form. These differences are represented as a set of abstract principles, formalized as axioms, which define the organization of cognitive processing.

If correctly specified, the axiomatic system is expected to generate characteristic patterns of autistic cognition, with those manifesting as observable behavioral or symptomatic features included. Importantly, the aim of the work is not to directly model specific behaviors, but rather to describe the underlying structural relations from which such patterns do emerge. Therefore, this work is not conceptualized as a mathematical model, but as a mathematical description.

The axioms are formulated at a general level, with emphasis on identifying the form of the underlying cognitive patterns before specifying their particular instantiations. Concrete models of cognition should therefore be derivable from the axiomatic system at decreasing levels of abstraction.

2.2.3 Abstraction of autism

Autistic cognition, as discussed in this work, is not understood as a particular diagnosis within autism spectrum conditions, but rather as an underlying pattern of cognitive organization that gives rise to the observed phenotypic variability across the spectrum. Note that full phenotypic variability typically involves additional interacting cognitive features, which are treated here as modulatory rather than defining components.

From a phenotypic perspective, we propose that this abstraction may be approximated by individuals corresponding to profiles historically described as Asperger syndrome (ASD Level 1), in whom interacting variables such as intellectual functioning and language abilities are sufficiently preserved so as not to substantially influence the underlying autistic processing characteristics.

2.2.4 Exclusions

The present work does not aim to provide a biological or neurological account of autism spectrum conditions. In particular, it does not attempt to model underlying neural mechanisms, genetic factors, or brain-level processes, focusing instead on the cognitive level of description.

Our framework is not intended as a diagnostic or clinical tool. The term “autism” is used here in a purely theoretical sense as an abstraction of a cognitive processing style, not as a reference to formal diagnostic criteria as defined in DSM-5-TR or ICD-11.

The model also does not aim to capture the full range of phenotypic variability observed across the autism spectrum. Differences in intellectual functioning, language ability, comorbid conditions, and developmental trajectories are treated as external modulatory factors and are therefore not modeled explicitly. Rather, our work aims to abstract away from these modulatory factors.

The framework is finally not designed to predict individual behavior. Its scope is limited to the high-level characterization of structural patterns that define a cognitive style, abstracted from specific implementations.

2.3 Justification of abstraction

2.3.1 Axiomatic description

This work adopts an axiomatic level of description for several reasons.

Firstly, empirical findings suggest that cognition exhibits structured patterns that shape how information is processed, with differences between autistic and allistic cases. While cognitive psychology has traditionally described these differences in terms of allistic patterns by default, with autistic deviations interpreted as pathology, the present work postulates them as distinct computational organizations of cognition. These differences may lead to distinct processing dynamics and their side effects, but importantly, still enable consistent functional behavior across both styles of cognitive computation.

Our axiomatic approach further allows these patterns to be described at a level of generality consistent with the strongly abstract nature of the considered phenomena. By formulating fundamental principles in terms of mathematical structure, which is an axiomatic system, the framework provides a logically consistent foundation from which further properties of cognition can be derived, provided that the system is well-defined.

Also, this perspective enables the incorporation of phenotypic variability in a formal manner. Observable diversity across individuals can be interpreted as resulting from the interaction between the core structural principles (autism), which do spread across the whole spectrum, and additional modulatory factors (e.g., comorbid conditions), which may be introduced as further mathematical units in the stage of interpreting the mathematical theory into a particular model.

2.3.2 Abstraction of autism

Autism is abstracted from its comorbidities on the grounds that it does not correspond to a single phenotype, nor can it be reduced to a unitary clinical disorder. Rather, it denotes a pattern of cognitive organization that is expressed across multiple conditions and phenotypic configurations.

This abstraction is not conducted for the purpose of simplification, but with the aim of isolating structural principles that underlie cognitive processing. The intention is to capture such principles as they operate, rather than as they appear under the influence of interacting/modulatory factors. In this way, the framework aims to approach the structure of cognition with maximal precision.

Our model phenotype of this abstraction is presented as discussed above, as intact cognitive abilities accompanying the autistic neurotype are assumed to reduce the influence of confounding variables in the modeling process.

2.3.3 Limitations of current descriptions

Despite the abstraction introduced above, current descriptions of autism remain limited in their suitability for formalization.

Reasons are such:

- They are qualitative by default and narrative in nature, lacking explicit definitions of relations necessary for systematic representation.
- Core cognitive processes, such as attention, interpretation, or salience, tend to be typically described in isolation or at differing levels of description. The lack of a unified structural framework then prevents the study of interactions between them.
- Existing accounts are largely phenotype-driven, focusing on observable outcomes rather than the underlying organization that gives rise to them.

As a result, these descriptions do not readily support the construction of a generative system capable of deriving cognitive patterns from first principles. This limitation motivates the transition toward an axiomatic description, in which the structure of cognition is defined in terms of explicitly stated and formally consistent principles.

Chapter 3

Cognitive architecture of the neurotype

3.1 General cognitive processing model

In order to establish a structured hierarchy of dependencies in the formalization of autistic cognition, we consider cognitive modalities according to the temporal order of information processing.

The information-processing model (Atkinson and Shiffrin, 1968) proposes that cognition can be described in terms of three major stages — input, processing, and output.

Building on this framework, we introduce a generalized model of cognitive processing.

To capture the structure of cognition at a finer level of resolution, this model is further expanded into an episodic timeline consisting of distinct cognitive processing states (Fig. 1):

1. **DEFAULT MODE**.

   By *default mode*, we understand a state in which no explicit task-driven information processing is occurring, and which represents a transitional baseline between consecutive episodes of cognitive processing.

   This state is characterized by the presence of a **default motivational drive** (intrinsic or extrinsic) and a **contextual bias** determined by pre-existing models and goals.

2. **SENSORY INFORMATION ACQUISITION**.

   By *sensory information acquisition*, we understand the acquisition of raw sensory data from the external environment through the sensory organs; however, the acquisition of information from the organism's internal state is not excluded.

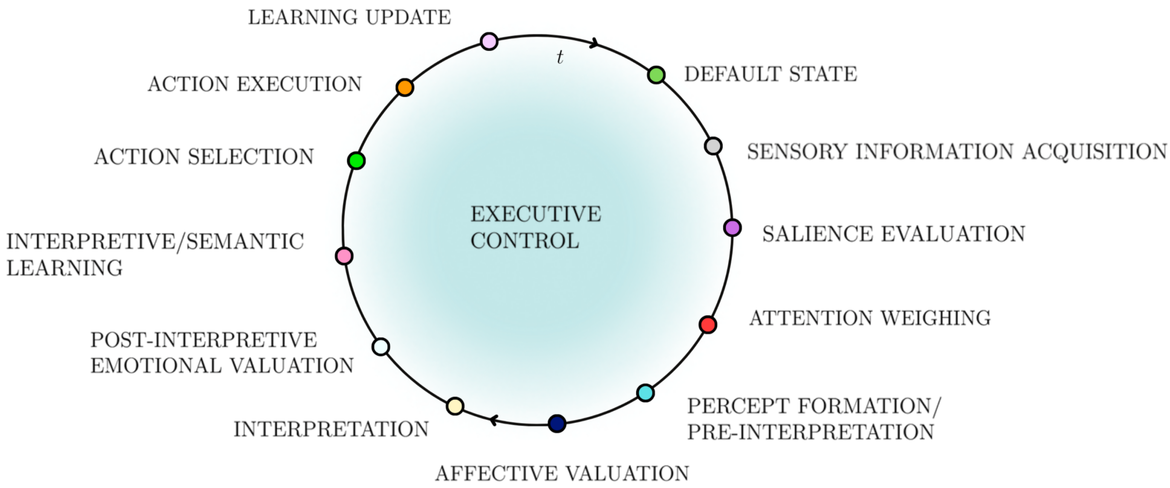

Figure 3.1: Cognitive loop scheme.

This process is generalized at this stage, as all information processed by the brain originates from some source, which is collectively referred to as **sensation**.

3. **SALIENCE EVALUATION**.

   By *salience evaluation*, we understand the assignment of salience to incoming stimuli, influenced by feature interpretation during early sensory acquisition. This process is understood as an early filtering mechanism, operating in such a way that stimuli with higher salience are more likely to undergo further processing than those with lower salience.

   This mechanism operates primarily automatically, while remaining subject to modulation by higher-level processes.

4. **ATTENTION WEIGHTING**.

   By *attention weighting*, we understand a selective allocation process that determines the degree to which particular information proceeds to further stages of processing. Information assigned a high level of attention is processed more intensively and is more likely to reach conscious awareness, whereas information with low attentional weighting remains pre-conscious or is excluded from further processing.

5. **PERCEPT FORMATION (PRE-INTERPRETATION)**

   Percept formation (or pre-interpretation) refers to the transformation of sensory input into structured representations suitable for subsequent cognitive processing.

Importantly, this process is modulated by *predictive mechanisms* that influence and transform incoming data prior to its formation into a percept.

6. **AFFECTIVE VALUATION**.

   By *affective valuation*, we understand a pre-reflective emotional appraisal of the percept, which precedes and modulates its subsequent cognitive interpretation.

7. **INTERPRETATION**.

   By *interpretation*, we understand the representation of the percept through which semantic and contextual meaning is ascribed to the stimulus, typically associated with conscious access.

8. **POST-INTERPRETIVE EMOTIONAL VALUATION**.

   By *post-interpretive emotional valuation*, we understand a higher-order, explicit emotional appraisal that integrates semantic understanding, contextual knowledge, and subjective meaning derived from prior interpretation.

   This phase constitutes the resulting emotional state of the process, shaping subsequent behavioural tendencies.

9. **SEMANTIC LEARNING**.

   By *semantic learning*, we understand the process of consolidating interpreted and emotionally appraised information in accordance with its subjective salience and relevance to the individual.

   It should be noted, however, that learning processes operate continuously across all preceding stages of information processing, albeit in distinct forms and magnitudes.

10. **ACTION SELECTION**.

    By *action selection*, we understand the process of selecting a response to the environment based on the preceding cognitive processing pipeline. This may involve motor, cognitive, or communicative actions.

3.2 Neurotype Differences

Although the cognitive pipeline itself may appear structurally universal, the manner in which individual stages of processing are computationally realized may differ substantially between neurotypes. At this point, we identify a conceptual limitation in cognitive psychology, which has historically tended to assume that the dominant pattern of cognition is universal and implicitly allistic.

Taking account of the evidence for differences in autistic neurological organization, sensory processing, and behavioral structure, we propose that autistic and allistic cognition are representatives of distinct computational organizations operating within a shared general cognitive architecture.

What is important to note is that these differences do not necessarily result in maladaptation or dysfunction. Functionally similar outcomes may be achieved by both systems through categorically different processing dynamics. However, speaking of function or dysfunction, it is necessary to assume that both systems operate under sufficiently compatible environmental conditions.

We therefore assume that across the autistic–allistic distinction, there exist systematic differences in the weighting, integration, validation, and prioritization of information throughout the cognitive pipeline. In some cases, these distinct computational pathways may nevertheless converge toward similar observable behaviors, such as in highly compensating or masking autistic individuals.

The following sections organize these differences across multiple levels of abstraction. This distinction allows us to separate fundamental computational principles (primitives) from their dynamic consequences, emergent system-level tendencies, behavioral manifestations, and subjective experiential correlates.

3.2.1 Levels of Description

Respecting the manner in which cognitive information is formed—beginning as an underlying computational pattern and subsequently emerging into behavioral tendencies, observable phenotypes, and subjective experience—we introduce a distinction between multiple levels of description. While the underlying pattern itself remains the subject of formal mathematical characterization, its consequences can be observed across increasingly higher levels of organization.

We therefore distinguish between the following levels of description:

- the axiomatic level,
- the cognitive-dynamic level,
- the emergent level,
- the phenotypic level, and
- the experiential level.

The axiomatic level serves as the foundation for the formal system. Cognitive-dynamic properties arise as direct computational consequences of these primitives.

Emergent properties then operate at the level of the cognitive system as a whole, constructing patterns of massive local interactions. In some cases, these emergent properties bridge computational structure and observable behavior. Phenotypic and experiential levels subsequently describe behavioral expression and subjective phenomenology.

Axiomatic Level

The axiomatic level contains the fundamental computational principles from which subsequent cognitive dynamics and emergent properties are expected to be derived. These principles are treated as primitive assumptions of the autistic and/or allistic cognitive structure and represent the highest level of abstraction considered within the present framework.

The axiomatic system proposed as the formal basis of the following levels of abstraction is outlined in Chapter 4.

Cognitive-Dynamic Level

The cognitive-dynamic level contains direct mechanistic consequences of the axiomatic structure. Unlike the primitives themselves, these properties already represent operational characteristics of information processing emerging from interactions between axioms.

- **Reduced contextual modulation**.

  Reduced contextual modulation refers to a tendency for information processing to be less strongly shaped by pre-existing contextual frameworks, global situational priors, and automatically activated interpretive expectations. It is expected to emerge from the interaction between reduced prior influence during integration, intrinsic salience allocation, and internally constrained validation mechanisms.

  For reference, in allistic cognition, contextual information is expected to play a strong modulatory role in influencing multiple processing stages. Continuous interpretation of incoming stimuli is guided by situational expectations, socially shared assumptions, and previously established global representations. The effectiveness of this contextual modulation is undeniable because it enables rapid orientation within complex environments by strong automatic filtering of incoming information. As a result, computational load is rapidly decreased, as only a subset of the available information is prioritized for deeper processing.

  However, in the case of autistic cognition, the influence of contextual modulation is expected to be reduced in a comparative manner. Individual stimuli are, as a consequence, expected to be processed more independently of surrounding contextual structures. In particular, rather than being rapidly absorbed into global interpretive frameworks, stimuli are expected to remain more strongly represented according to their own intrinsic structural properties. This is expected to result in increased sensitivity to local details, atypical patterns of prioritization, and greater persistence of perceptual information that would otherwise be automatically filtered out through predictive contextual mechanisms.

Importantly, reduced contextual modulation does not imply an absence of contextual understanding. Rather, the present framework proposes that in the case of autistic cognition, contextual influence enters processing differently and with reduced automatic dominance. Context may therefore require more explicit integration and conscious reconstruction instead of functioning as a continuously active, but implicit constraint on interpretation at the same time.

In further stages of description, reduced contextual modulation is expected to lead to an increased sensitivity to inconsistencies and an enhanced ability to detect fine-grained structural deviations. It may also result in a reduced susceptibility to contextual illusions or to often-present socially shared shortcuts in interpretation.

The present conceptualization partially overlaps with theories of autism involving predictive processing, particularly with accounts proposing attenuation of priors or reduced top-down predictive influence in autistic cognition (Pellicano and Burr, 2012; Van de Cruys et al., 2014). However, unlike these accounts, the present proposed framework expects for a reduced contextual modulation to be situated within a broader interaction involving the allocation of salience, integrative dynamics, and pools of attention and validation.

Within the proposed hierarchy of description, an intermediate position between axiomatic principles and large-scale emergent properties is considered to be occupied by reduced contextual modulation. It is expected to contribute to the emergence of some higher-level systemic properties, namely, detail-oriented processing, explicit social cognition, enhanced pattern sensitivity, and increased representational granularity.

- **Temporal integration differences**.

  Temporal integration differences refer to alterations in the manner by which information is accumulated, stabilized, and integrated across time during cognitive processing. Within the present framework, this property is treated as a cognitive-dynamic consequence of the underlying axiomatic structure, emerging primarily from bottom-up integration, altered attentional dynamics, intense processing, and reduced predictive compression.

  For reference, in allistic cognition, integration across time is expected to occur relatively quickly, with significant support from contextual information and predictive processes. This is expected to stand behind fast orientation and rapid contextual adaptation. However, such an accelerated convergence may result in fine-grained representational detail being lost during processing.

However, in the case of autistic cognition, integration is expected to occur over longer or more variable temporal intervals. The system is expected to preserve local information and continue integrating additional structural details before any convergence can be achieved, as opposed to collapsing them into immediately stabilized representations. This is expected to result in a slower cognitive stabilization, but potentially with greater precision of representation and internal consistency.

Importantly, we do not expect temporal integration differences to automatically imply globally slower cognition. Certain stimuli, as are for example highly structured or intrinsically salient ones, are prone to being processed with extreme efficiency.

Such description partially overlaps with accounts suggesting atypical temporal binding, alternations in multisensory temporal integration, and predictive-related differences in autism spectrum conditions (Van de Cruys et al., 2014; Pellicano and Burr, 2012; Robertson and Baron-Cohen, 2017). However, within our description, temporal integration differences are not treated as perceptual abnormalities in isolation, but involve salience dynamics, integration structure, attentional amplification, and representational stabilization.

These temporal differences are expected to contribute to the emergence of sustained attentional focus, delayed but intensified affective responses, high representational reconfiguration cost, and explicit social processing.

- **Altered attentional dynamics**.

  Altered attentional dynamics refer to differences in the stability, redistribution, and allocation of attentional resources throughout cognitive processing. Within the present framework, this property is treated as a cognitive-dynamic consequence emerging primarily from attentional gain amplification, intrinsic salience allocation, intense processing, and bottom-up integration.

  In allistic cognition, we expect attention to be highly responsive to contextual modulation and socially mediated relevance cues. This enables rapid redistribution in response to changing environmental demands. Such flexibility allows allistic neurotypes to adapt efficiently and orient quickly in dynamic environments.

  In autistic cognition, by contrast, attentional allocation is expected to remain more stable once established. Following salience allocation, selected stimuli may retain attention for extended periods, with reduced susceptibility to contextual reallocation. Consequently, we expect the attention to remain more strongly governed by intrinsic structural salience.

This distinction may support prolonged engagement with selected stimuli, accompanied by sustained analytical processing and increased representational depth. Simultaneously, it contributes to difficulty in rapidly transitioning between competing informational streams, particularly in demanding environments with greater density (social or otherwise).

Such dynamics may contribute to the emergence of sustained attentional focus, detail-oriented processing, and high representational reconfiguration cost. Under further conditions, these tendencies may manifest phenotypically as hyperfocus or difficulty disengaging from ongoing cognitive states.

This perspective partially overlaps with empirical findings describing atypical attentional allocation, enhanced perceptual persistence, and altered attentional shifting in autism spectrum conditions (Keehn et al., 2013; Robertson and Baron-Cohen, 2017). Attentional dynamics are also, however, interpreted not as isolated differences, but as coherent consequences of the broader cognitive configuration.

Within the proposed hierarchy of description, we expected the cognitive-level attentional dynamics to contribute to higher-level properties such as sustained attentional focus, enhanced pattern sensitivity, and delayed affective convergence.

- **Altered affective coupling**.

  Altered affective coupling refers to differences in the relationship between perceptual processing, interpretation, and emotional valuation. Within the present framework, this property is treated as a cognitive-dynamic consequence emerging from bottom-up integration, intense processing, altered attentional dynamics, and internally constrained validation.

  In allistic cognition, affective responses are expected to remain continuously integrated throughout processing, enabling immediate emotional appraisal and contextual adaptation.

  In autistic cognition, by contrast, emotional valuation is expected to become more strongly associated with later interpretive stages rather than with immediate perceptual processing. Consequently, emotional responses may emerge less automatically at early stages, but become disproportionately intensified following representational stabilization and semantic integration.

  Importantly, this distinction does not imply any kind of reduced emotionality.

Rather, emotional significance is expected to depend more strongly on later interpretation and internal validation than on immediate contextual appraisal.

Such dynamics may contribute to delayed affective convergence, prolonged emotional persistence, and increased difficulty disengaging from emotionally significant representations. They may additionally contribute to the explicit and analytical character of social cognition, as emotional understanding may require more conscious interpretive reconstruction before stabilization occurs.

This conceptualization partially overlaps with findings describing atypical emotional processing, alexithymic tendencies, delayed emotional recognition, and altered interoceptive integration in autism spectrum conditions (Bird and Cook, 2013; Shah et al., 2016). However, within the present framework, altered affective coupling is as well represented not as an isolated emotional abnormality, but as a consequence of broader interactions between integration dynamics, attentional stabilization, and coherence-sensitive validation.

Altered affective coupling is expected to contribute to properties such as delayed but intensified affect, sustained emotional persistence, and explicit social processing.

- **Increased representational granularity**.

  By increased representational granularity, we refer to the tendency for cognitive representations to retain substantial structural detail prior to abstraction and stabilization. Within the present hierarchy, this property is treated as a consequence emerging primarily from altered input gain, bottom-up integration, and intense processing.

  As a reference, in allistic cognition, representations are expected to undergo relatively rapid abstraction into stable global models guided by contextual priors. As a result, fine-grained distinctions may early become compressed into broader representational categories.

  In autistic cognition, representations are expected to preserve strong local structural variation before any simplifying stabilization (convergence).

  Importantly, increased representational granularity does not imply globally superior cognition, but rather a different organization of representational space. Such dynamics may support enhanced sensitivity to subtle distinctions, structural irregularities, and detailed pattern relations, while simultaneously increasing computational demands during large-scale integration.

  This conceptualization partially overlaps with accounts proposing enhanced perceptual functioning, reduced central coherence, and altered predictive processing in autism spectrum conditions (Mottron et al., 2006; Happe and Frith, 2006; Pellicano and Burr, 2012). However, within the present framework, representational granularity is interpreted not as an isolated perceptual bias, but as a broader property of representational organization emerging from interactions between integration dynamics, attentional amplification, and input weighting.

Increased representational granularity is expected to contribute to detail-oriented processing, enhanced pattern sensitivity, and high representational reconfiguration cost.

Emergent Level

Emergent properties arise as large-scale systemic consequences of interactions between cognitive-dynamic mechanisms, including primitives. Although grounded in underlying computational structure, these properties already represent organized processing tendencies operating at the level of the system as a whole.

These emergent tendencies serve as an important basis for the subsequent derivation of theorems within the proposed axiomatic framework.

- **Detail-oriented processing.**

  By detail-oriented processing, we refer to a system-level tendency to preserve and prioritize local stimulus features over rapid global abstraction. This property is already a discussed part of diagnostic protocols, with ADOS-2 included, and is expected to arise from the interaction between bottom-up integration, intrinsic salience allocation, attentional amplification, and intense processing.

  The property is consistent with weak central coherence accounts, which describe autistic cognition as biased toward local rather than global processing (Happe and Frith, 2006). In the present framework, however, detail-oriented processing is not introduced as an explanatory primitive. Instead, it is treated as a consequence of more general computational assumptions about salience, attention, and integration, which are already active at the time of unconscious percept formation.

  This distinction is important to us, especially because the same emergent property may yield different behavioral outcomes. In some cases, it may appear as enhanced attention to (perceptual) detail; in others, as analytical reasoning, detection of inconsistencies, or slower global integration. Thus, detail-oriented processing already links the proposed axiomatic structure with observable autistic traits.

- **Autonomous cognition**.

Autonomous cognition refers to an individual's tendency to engage in cognitive processing in isolation from external motivational cues, shared consensus, and communicative demands.

In autistic cognition, this tendency is expected to emerge from stronger reliance on intrinsic motivation, validation based on internal coherence, and locally accumulated information during interpretation.

Cognitive processing may remain comparatively independent from social interpretations in these individuals, particularly when social consensus conflicts with their internally derived conclusions.

It should, however, definitely not be understood as social opposition or reduced social awareness. Instead, socially shared interpretations appear to play a weaker role in validation and motivational regulation. This may support independent reasoning, unconventional problem-solving, and reduced conformity to unsupported authority structures, while simultaneously increasing demands during social interpretation.

This is consistent with findings describing altered social reward processing and increased independence from social influence in autism spectrum conditions (Chevallier et al., 2012). Within the present framework, however, autonomous cognition is understood as a consequence of differences in salience allocation, validation, motivation, and integration rather than as a social deficit.

- **Sustained attentional focus**.

  By sustained attentional focus, we refer to a tendency for attentional allocation to remain stable once it gets established, resulting in prolonged engagement with selected stimuli or cognitive processes. In our model, this tendency is expected to follow from the interaction between salience allocation, deep processing, and stabilization of cognitive representations.

  In allistic cognition, attention tends to shift rapidly according to contextual and social demands.

  In autistic cognition, by contrast, attentional allocation is expected to remain more strongly coupled to intrinsically salient or structurally engaging representations once selected.

  Sustained attentional focus should, importantly, not be understood as either superior concentration or impaired flexibility. In our model, prolonged attentional engagement follows from strong salience allocation and stabilization of selected representations. As a result, shifting attention away from highly engaging stimuli may require greater cognitive restructuring than in allistic cognition.

Such dynamics may support prolonged analytical engagement and deep exploration of selected topics, but may also make rapid shifts between tasks or disengagement from an ongoing focus more difficult.

This is consistent with findings on atypical attentional shifting, monotropism, and prolonged engagement with selected interests in autism spectrum conditions (Murray et al., 2005; Keehn et al., 2013). In our model, prolonged attentional engagement results from strong salience-driven processing and stabilization of selected representations, not simply from an attentional deficit.

Sustained attentional focus is expected to contribute to phenomena such as hyperfocus and increased representational persistence.

- **Explicit social processing**.

  Explicit social processing refers to a tendency for social situations to require more conscious interpretation rather than being processed automatically through implicit social intuition. In our model, this follows from weaker contextual guidance and stronger reliance on locally accumulated information during interpretation.

  In allistic cognition, social situations are often interpreted quickly and intuitively through contextual cues.

  In autistic cognition, social understanding may require more conscious interpretation and deliberate reasoning before a stable conclusion is reached.

  Explicit social processing should not be understood as reduced social cognition or emotional understanding, however. Instead, social situations may require more conscious interpretation and sustained attention before a clear understanding is reached.

  This may contribute to social fatigue, conscious analysis of social situations, and difficulty quickly interpreting interactions in socially demanding environments. Also, masking strategies may be supported based on learned social behavior.

  This is consistent with findings on camouflaging, compensatory social strategies, and rule-based social reasoning in autism spectrum conditions (Hull et al., 2017; Livingston et al., 2019; Frith, 2003).

  Explicit social processing may contribute to phenomena such as social fatigue, conscious reconstruction of interactional meaning, and increased cognitive load during and after social engagement.

- **Delayed but intensified affect**.

  In allistic cognition, emotional responses are often closely linked to immediate perception and contextual interpretation.

In autistic cognition, however, emotional responses may develop more gradually and tend to intensify after prolonged reflection and internal processing.

Delayed but intensified affect should not, importantly, be understood as any reduced emotionality. Instead, emotional responses may become strongly tied to internal interpretations once they stabilize and remain active long after the original event.

This may contribute to prolonged emotional processing and difficulty letting go of emotionally significant experiences. In social contexts, emotional understanding may sometimes emerge only after the interaction has already ended.

This account is consistent with findings describing emotional persistence, delayed emotional recognition, altered interoceptive processing, and alexithymic tendencies in autism spectrum conditions (Bird and Cook, 2013; Shah et al., 2016). In our model, however, these patterns reflect broader differences in attention, integration, and stabilization rather than isolated emotional deficits.

Within the proposed hierarchy of description, delayed but intensified affect may contribute to emotional persistence and increased cognitive-emotional overload.

- **Enhanced pattern sensitivity**.

  Enhanced pattern sensitivity refers to increased sensitivity to regularities, inconsistencies, and structural relations within perceptual and conceptual input. In our model, this follows from preservation of fine-grained information during processing and stronger reliance on local structure during interpretation.

  In allistic cognition, information is often interpreted quickly through contextual expectations, sometimes at the expense of fine detail.

  In autistic cognition, local details may remain relevant for longer during processing, increasing sensitivity to subtle patterns and inconsistencies. Moreover, subjective satisfaction with regularity is expected to support pattern seeking in autistic cognition.

  Enhanced pattern sensitivity should, importantly, not be understood as any general cognitive superiority or as an ability limited to domains such as mathematics or music. Instead, the present conceptualization proposes a broader cognitive tendency to preserve structural detail across different types of information.

  It may support analytical reasoning and sensitivity to inconsistencies, while also increasing susceptibility to cognitive overload in environments rich in stimuli, on the other hand.

  This account is consistent with findings on enhanced perceptual functioning, weak central coherence, and increased systemizing tendencies in autism spectrum conditions (Mottron et al., 2006; Happe and Frith, 2006; Baron-Cohen et al., 2009). In our model, however, we do not reflect that as an isolated perceptual enhancement, but rather as broader differences in how information is processed and stabilized.

Enhanced pattern sensitivity is expected to contribute to detail-oriented processing, coherence sensitivity, and atypical salience allocation.

- **Reduced tolerance for inconsistency**.

  Reduced tolerance for inconsistency refers to a tendency for interpretations and cognitive models to require higher internal coherence before they stabilize. In our model, this follows from validation based on internal coherence and prolonged integration of detailed information during processing.

  In allistic cognition, interpretations are expected to stabilize despite partial ambiguity when rapid contextual simplification is advantageous.

  In autistic cognition, on the other hand, unresolved or internally inconsistent interpretations are disruptive and therefore remain active longer and require more extensive integration before a stable interpretation is reached.

  Reduced tolerance for inconsistency should not be understood in simplification as rigidity or perfectionism. In our conceptualization, internal coherence plays a crucial role in how the stabilization of interpretations occurs. As a result, inconsistencies that might be negligible in allistic cognition are expected to continue actively influencing processing in autistic cognition.

  This may support detection of contradictions, logical gaps, and hidden relational conflicts while also slowing interpretation and increasing cognitive load significantly in complex or rapidly changing contextual demands.

  Our account is consistent with findings on detail-focused processing and predictive-processing differences in autism spectrum conditions (Happe and Frith, 2006; Van de Cruys et al., 2014). In our model, however, reduced tolerance for inconsistency reflects predominantly differences in validation, as well as integration, and representational stabilization rather than generalized cognitive rigidity.

  Reduced tolerance for inconsistency is expected to contribute to autonomous learning, resistance to authority, or explicit understanding.

- **High representational reconfiguration cost**.

  High representational reconfiguration cost refers to a tendency for stabilized cognitive representations to require greater cognitive restructuring once they are formed. Such property is expected to arise from deep processing, coherence-sensitive validation, and increased representational stabilization.

In allistic cognition, interpretations are expected to be updated relatively quickly in response to changing contextual demands.

In autistic cognition, stabilized representations may remain more persistent as a consequence of the requirement for more extensive reintegration before reinterpretation occurs.

High representational reconfiguration cost should not be understood simply as rigidity or inability to adapt. Representations are rather expected to become more internally elaborated and structurally persistent once they are stabilized. As a result, unexpected contextual changes may require greater cognitive restructuring and prolonged adaptation.

On the positive side, stable representations may support deep to exceptional conceptual organization or resistance to insufficiently justified reinterpretations.

Such an account is consistent with findings on reduced attentional shifting, insistence on sameness, or difficulties with rapid transitions of context in autism spectrum conditions (Murray et al., 2005; Keehn et al., 2013). In our model, however, representational persistence reflects broad differences and interactions across integration, stabilization, and processing depth rather than generalized cognitive rigidity.

Within the proposed hierarchy of description, high representational reconfiguration cost is expected to contribute to difficulty with adaptation to change and difficulty rapidly shifting interpretive frameworks.

- **Reduced automatic weighting of social-status cues**.

  Reduced automatic weighting of social-status cues refers to a tendency for authority and hierarchy-related information to exert weaker automatic influence on attention, validation, and motivation. In our description, this property is expected to stem from intrinsic motivation, internally guided validation, and reduced dependence on socially mediated salience.

  In allistic cognition, authority and social hierarchy often strongly influence interpretation and behavior.

  In autistic cognition, however, authority and status cues are expected to carry less automatic weight and continue being evaluated more independently according to the content of the information itself.

  This does, importantly, not mean absence of social awareness or deliberate opposition to authority. Rather, social-status information may need to make sense internally before strongly influencing interpretation or behavior.

This may support independent reasoning and reduced conformity to social consensus, while also increasing difficulty navigating strongly hierarchical social environments.

This account is consistent with findings on reduced conformity effects, altered social reward processing, and increased independence from social influence in autism spectrum conditions (Chevallier et al., 2012). In our model, however, reduced weighting of hierarchy-related information reflects broader differences in salience allocation, validation, and motivation rather than impaired social functioning.

Reduced automatic weighting of social-status cues is expected to contribute to independent reasoning or resistance to social authorities.

Phenotypic Level

The phenotypic level describes observable behavioral tendencies associated with the proposed cognitive organization. These manifestations are expected to emerge through interactions between underlying cognitive properties and environmental context, and may therefore vary substantially across individuals and situations.

Potential phenotypic manifestations include:

- **Preference for routine and predictability**: A tendency to prefer stable environments and predictable situations, potentially emerging from high representational reconfiguration cost, difficulty with attentional relocation, and increased load-wise demands associated with rapid cognitive restructuring.

- **Hyperfocus on selected interests**: Extended engagement with intrinsically salient stimuli resulting from sustained attentional focus, intrinsic motivational dominance, and deep processing of selected information.

- **Increased sensitivity to inconsistency or contradiction**: Heightened behavioral responsiveness to logical, perceptual, or social inconsistencies emerging from coherence-sensitive validation and enhanced pattern sensitivity. This may manifest as increased criticism of internally inconsistent explanations, difficulty accepting unsupported claims, or heightened sensitivity to contradiction in social and conceptual contexts.

- **Explicit verbalization of social reasoning**: A tendency to consciously reconstruct, verbalize, or analytically explain social interactions and interpersonal dynamics due to explicit social processing. This may contribute to reflective social analysis, explicit discussion of interpersonal dynamics, or increased interest in psychologically oriented forms of art and storytelling.

- **Reduced automatic conformity to social hierarchy**: Reduced spontaneous behavioral alignment with authority structures or socially assigned prestige cues resulting from internally constrained validation and reduced automatic weighting of hierarchy-related information. This may manifest as independent behavior misinterpreted as rebellion or arrogance. At the same time, it may also contribute to social naivety or atypical trust or attachment toward authority figures.

- **Enhanced attention to detail**: Increased behavioral focus on local informational structure, subtle distinctions, and fine-grained perceptual or conceptual features resulting from detail-oriented processing and increased representational granularity.

- **Idiosyncratic or non-standard problem-solving strategies**: A tendency to approach problems through internally generated structural reasoning rather than through conventionally shared heuristics or socially dominant interpretive frameworks.

- **Analytical persistence**: Prolonged cognitive engagement with unresolved representations, inconsistencies, or structurally complex problems due to sustained attentional focus and reduced tolerance for inconsistency.

- **Intense engagement with highly structured domains**: Strong attraction toward activities or systems characterized by regularity, coherence, or complex patterns.

Importantly, phenotypic manifestations are expected to remain highly dependent on environmental compatibility. Under conditions in which environmental structure aligns with the described cognitive organization, many of these manifestations may support highly adaptive functioning. Conversely, environments characterized by excessive unpredictability, high informational density, or strong dependence on implicit social heuristics may increase cognitive load and lead to maladaptive behavioral and experiential outcomes.

Experiential Level

The experiential level describes subjective phenomenological correlates associated with the proposed cognitive organization. Unlike the phenotypic level, which concerns externally observable behavioral manifestations, the experiential level refers to the internal subjective experience accompanying ongoing cognitive processing.

Because identical computational dynamics may produce different experiential outcomes depending on environmental conditions and compensatory strategies, subjective experience is expected to remain highly variable across individuals. The purpose of this level of description is therefore not phenomenological classification itself, but rather the identification of recurrent experiential tendencies potentially derivable from the proposed cognitive structure.

Potential experiential correlates include:

- **Sensory overload or understimulation**: Subjective experiences of excessive perceptual intensity or insufficient sensory stimulation emerging from altered input gain and reduced predictive attenuation.
- **Deep immersion in selected activities**: Highly absorptive experiential states associated with sustained attentional focus and intrinsic motivational dominance.
- **Prolonged emotional persistence**: Emotional experiences remaining subjectively active for extended periods of time due to delayed but intensified affect and high representational stabilization.
- **Cognitive overload in information-rich environments**: Subjective exhaustion occurring in contexts containing large amounts of simultaneously competing stimuli.
- **Effortful social interpretation**: Subjective perception of social interaction as cognitively demanding due to explicit social processing and reduced automatic contextual stabilization.
- **Heightened awareness of structural inconsistency**: Increased subjective sensitivity to contradictions, irregularities, or unresolved ambiguity resulting from coherence-sensitive validation and enhanced pattern sensitivity.
- **Subjective perception of excessive informational detail**: Experience of perceptual or conceptual environments as unusually information-rich due to increased representational granularity and reduced predictive compression.
- **Retrospective emotional intensification**: Emotional responses becoming subjectively stronger after interpretation stabilizes rather than during immediate perceptual experience.
- **Reduced intuitive alignment with socially shared interpretations**: Subjective feeling of observing social structures analytically rather than automatically participating within them.
- **Increased sensitivity to unpredictability**: Subjective discomfort associated with abrupt contextual change or unstable environmental structure due to high representational reconfiguration cost.

3.2.2 Dependency Structure

The proposed hierarchy may be summarized as follows:

AXIOMATIC LEVEL

$\downarrow$

COGNITIVE-DYNAMIC LEVEL

$\downarrow$

EMERGENT LEVEL

$\downarrow$

PHENOTYPIC LEVEL

$\downarrow$

EXPERIENTAL LEVEL

In the next chapters, we will introduce an axiomatic system proposed to generate cognitive-level and emergent-level properties, from which the phenotypic and experiential levels are derivable, and, importantly, empirically comparable.

Chapter 4

Axiomatic Framework

4.1 Formal definition

An axiomatic system is a formally specified collection of primitive assumptions from which further statements of a theory may be logically derived. Within a mathematical framework, axioms are treated as undefined or non-derived principles constituting the foundational structure of the system (Enderton, 2001).

The purpose of an axiomatic system is to provide a minimal set of assumptions from which a coherent formal theory may be derived. The theoretical consequences are derived from these assumptions through explicit logical inference.

In formal terms, an axiomatic system constitutes a structure

$$\mathcal{A} = (L, \Sigma),$$

where L denotes a formal language and Σ denotes a set of axioms formulated within that language.

The formal language L specifies the symbols and syntactic rules of the theory. Typically, it consists of:

$$L = (C, F, R),$$

where

- C is a set of constant symbols,
- F is a set of function symbols,
- R is a set of relation symbols.

The axioms Σ are then well-formed formulas constructed within L.

For an axiomatic system to constitute a meaningful formal theory, several properties need to be satisfied.

- **Consistency.** The system should not permit derivation of both a statement and its negation. Formally, there should not exist a proposition P such that

$$\Sigma \vdash P \quad \text{and} \quad \Sigma \vdash \neg P.$$

- **Non-redundancy (independence).** Individual axioms should not be derivable from the remaining axioms of the system. For an axiom $A_i \in \Sigma$,

$$\Sigma \setminus \{A_i\} \nvdash A_i.$$

- **Generativity.** The axioms should permit derivation of non-trivial consequences extending beyond the primitive assumptions themselves.

- **Interpretability.** The formal structure should admit interpretation within a specified semantic domain, allowing theoretical expressions to correspond to meaningful entities or relations.

- **Internal structural coherence.** The axioms should be formulated so that their interaction contributes to a unified theoretical structure.

Primitive assumptions are introduced at the axiomatic level because further derivation within the system requires the existence of foundational non-derived elements. Without such primitives, the construction of a formal theory would lead either to infinite regress or circular definition.

4.2 Axioms in natural language

As elaborated in Chapter 3, higher-order properties of the autistic cognitive system are expected to be derivable from an underlying axiomatic framework satisfying the formal requirements of an axiomatic system.

Axiom 1 (Input Gain)**.** Perceptual and interoceptive signals are processed with elevated gain prior to salience computation, relative to typical predictive attenuation.

Axiom 2 (Salience Allocation)**.** Salience is weighted primarily by intrinsic structural properties of stimuli rather than by socially mediated relevance.

Axiom 3 (Temporal Priority)**.** Attentional allocation is governed by a weighted combination of temporal order and contextual relevance, with greater relative weighting assigned to temporal order.

Axiom 4 (Attentional Gain)**.** Attentional allocation exhibits elevated competitive contrast, whereby a small number of stimuli receive a disproportionately large share of the available attentional resources, while the remaining stimuli receive comparatively little attention.

Axiom 5 (Intense Processing)**.** Representational depth increases with attentional allocation. In the autistic system, highly attended stimuli are processed with disproportionately greater depth than in the non-autistic system.

Axiom 6 (Validation)**.** Cognitive validation operates primarily via internal consistency constraints rather than intersubjective alignment.

Axiom 7 (Integration)**.** Global models are constructed through progressive integration of locally accumulated stimulus information and existing model states. In the autistic system, the influence of pre-activated global priors on this integration is reduced, resulting in model updates that are more strongly driven by locally accumulated information.

Axiom 8 (Motivation)**.** Motivational drive is governed primarily by intrinsic reward signals, with comparatively weaker influence of externally mediated incentives.

Each axiom introduces a distinct mechanism of cognitive processing situated within the cognitive pipeline (Fig. 4.1). Some stages of the pipeline are intentionally left without direct axiomatic assignment, as processes occurring during these phases are expected to emerge as consequences of interactions between multiple axioms.

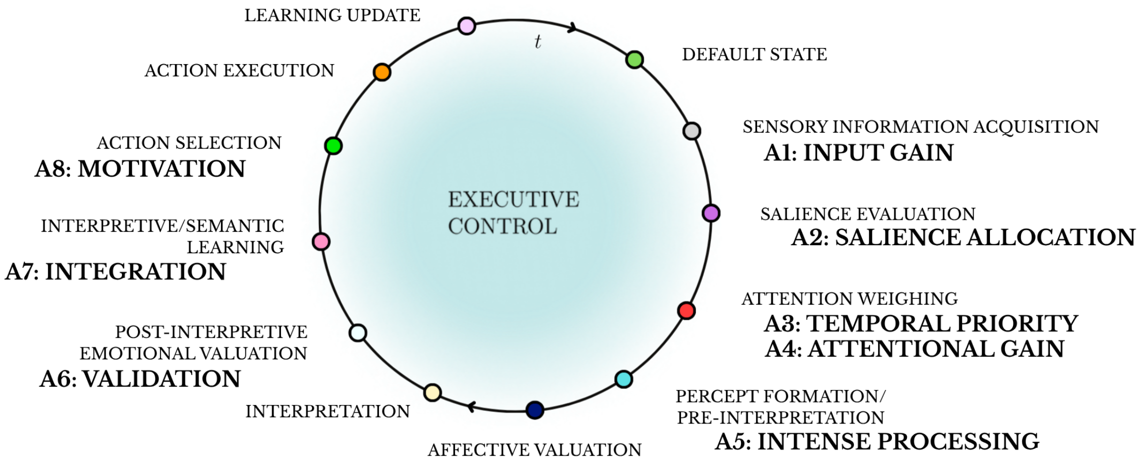

Figure 4.1: Axioms around cognitive pipeline

4.3 Axioms in mathematics

4.3.1 Notation

- Scal – ordered scalar domain equipped with binary operations $+$, $-$, and $\cdot$, order relation $<$, and distinguished constants 0 and 1.

- $\mathcal{S}$ – set of concurrent stimuli, with $s \in \mathcal{S}$.

- Systems $\Sigma \in \{A, N\}$, where A – autistic system, N – non-autistic system.

- $x_\Sigma : \mathcal{S} \to \mathbb{R}$ – centrally represented signal magnitude of stimulus s. Centrally represented means that the stimulus has been mapped from peripheral sensory space into an internally encoded scalar magnitude within the central nervous system of system Σ.

- $\phi : \mathcal{S} \to \mathbb{R}^{d_I} \times \mathbb{R}^{d_S}$, $\phi(s) = (\phi_I(s), \phi_S(s))$. Feature representation of stimulus s, decomposed into intrinsic (I) and social (S) components.

- g_I, g_S – feature evaluation mappings.

- $u^\Sigma : \mathcal{S} \to \mathbb{R}$ – pre-normalized selection score (attention utility) for stimulus s.

- $T : \mathcal{S} \to \mathbb{R}_{\geq 0}$ – time of central representation of stimulus s relative to the onset of the current stimulus set.

- $\kappa : \mathcal{S} \to \mathbb{R}_{\geq 0}$ – context-driven urgency of stimulus s, quantifying its potential to trigger global attentional reallocation.

- $w^\Sigma(s \mid \mathcal{S}) \in [0, 1]$ – attention weight allocated to stimulus s within the set $\mathcal{S}$, satisfying
$$\sum_{s \in \mathcal{S}} w^\Sigma(s \mid \mathcal{S}) = 1.$$

- $D_\Sigma(s)$ – representational depth allocated to stimulus s.

- C – representational capacity constraint.
Hold
$$\sum_{s \in \mathcal{S}} D_\Sigma(s) \leq C.$$

- K_Σ – internal global model of the environment maintained by system Σ.

- $\mathcal{L}_\Sigma(K; data)$ – operator measuring inconsistency between model K and processed data.

- $\mathcal{R}_\Sigma(K; others)$ – operator measuring mismatch between model K and intersubjective alignment constraints.
- $I(K)$ – intrinsic reward associated with improvement of internal model coherence.
- $E(K)$ – extrinsic reward associated with social evaluation or external incentives.
- M_Σ – motivational drive governing allocation of cognitive effort.

4.3.2 Axiom set $\mathcal{A}$

Axiom 1 (Input Gain)**.** Let $\mathcal{S} \subseteq \mathsf{Stim}$ denote a concurrent stimulus set, and let $x_\Sigma : \mathsf{Stim} \to \mathbb{R}$ denote the signal magnitude function for system $\Sigma \in \{A, N\}$. Then

$$\forall s \in \mathcal{S}, \qquad x_A(s) \geq x_N(s),$$

and

$$\exists s \in \mathcal{S} \quad x_A(s) > x_N(s).$$

Axiom 2 (Salience Allocation)**.** Let $\mathcal{S} \subseteq \mathsf{Stim}$ denote a concurrent stimulus set. Let $\phi_I : \mathsf{Stim} \to \mathsf{Feat}_I, \phi_S : \mathsf{Stim} \to \mathsf{Feat}_S$ be feature-representation functions, and let $g_I : \mathsf{Feat}_I \to \mathsf{Scal}, g_S : \mathsf{Feat}_S \to \mathsf{Scal}$ be feature-evaluation functions.

For all $s \in \mathcal{S}$ and $\Sigma \in \{A, N\}$,

$$\beta_I^\Sigma(s) \geq 0, \qquad \beta_S^\Sigma(s) \geq 0,$$

$$\beta_I^\Sigma(s) + \beta_S^\Sigma(s) = 1,$$

and

$$u_{\text{sal}}^\Sigma(s) = \beta_I^\Sigma(s)\, g_I(\phi_I(s)) + \beta_S^\Sigma(s)\, g_S(\phi_S(s)).$$

Moreover, for all $s \in \mathcal{S}$, if $g_I(\phi_I(s)) > 0 \wedge g_S(\phi_S(s)) > 0$, then

$$\beta_I^A(s) > \beta_S^A(s), \qquad \beta_S^N(s) \geq \beta_I^N(s).$$

Axiom 3 (Priority Modulation)**.** Let $\mathcal{S} \subseteq \mathsf{Stim}$ denote a concurrent stimulus set. Let $T, \Delta T, \kappa, c : \mathsf{Stim} \to \mathsf{Scal}$ be function symbols denoting central encoding time, stimulus age, urgency, and contextual relevance, respectively.
Let $u_{\text{pri}}^\Sigma : \mathsf{Stim} \to \mathsf{Scal}$ denote the priority component of attentional utility for system $\Sigma \in \{A, N\}$.

There exist function symbols $f_A : \mathsf{Scal} \times \mathsf{Scal} \to \mathsf{Scal}$ and $f_N : \mathsf{Scal} \times \mathsf{Scal} \times \mathsf{Scal} \to \mathsf{Scal}$ such that for all $s \in \mathcal{S}$,

$$u_{\text{pri}}^A(s) = f_A(\Delta T(s), \kappa(s)),$$

and

$$u_{\text{pri}}^N(s) = f_N(\Delta T(s), \kappa(s), c(s)).$$

The autistic priority function is decreasing in stimulus age:

$$\forall s_i, s_j \in \mathcal{S}\Big(\Delta T(s_i) < \Delta T(s_j) \wedge \kappa(s_i) = \kappa(s_j) \to u_{\text{pri}}^A(s_i) > u_{\text{pri}}^A(s_j)\Big).$$

The autistic priority function is increasing in urgency:

$$\forall s_i, s_j \in \mathcal{S}\Big(\kappa(s_i) > \kappa(s_j) \wedge \Delta T(s_i) = \Delta T(s_j) \rightarrow u^A_{\text{pri}}(s_i) > u^A_{\text{pri}}(s_j)\Big).$$

There exists $\theta > 0$ such that

$$\forall s_i, s_j \in \mathcal{S}\Big(\kappa(s_i) < \theta \wedge \kappa(s_j) < \theta \wedge \Delta T(s_i) < \Delta T(s_j) \rightarrow u^A_{\text{pri}}(s_i) > u^A_{\text{pri}}(s_j)\Big),$$

and

$$\forall s_i, s_j \in \mathcal{S}\Big(\kappa(s_i) \geq \theta \wedge \kappa(s_j) < \theta \rightarrow u^A_{\text{pri}}(s_i) > u^A_{\text{pri}}(s_j)\Big).$$

Axiom 4 (Attentional Gain)**.** Let $\mathcal{S} \subseteq \mathsf{Stim}$ denote a concurrent stimulus set. Let $u^\Sigma, u^\Sigma_{\text{sal}}, u^\Sigma_{\text{pri}} : \mathsf{Stim} \rightarrow \mathsf{Scal}$ denote total, salience, and priority utility functions for system $\Sigma \in \{A, N\}$.

For all $s \in \mathcal{S}$,

$$u^\Sigma(s) = u^\Sigma_{\text{sal}}(s) \cdot \big(1 + u^\Sigma_{\text{pri}}(s)\big).$$

Let $w^\Sigma : \mathsf{Stim} \rightarrow \mathsf{Scal}$ denote attentional allocation functions. For all $s_i, s_j \in \mathcal{S}$,

$$u^\Sigma(s_i) > u^\Sigma(s_j) \rightarrow w^\Sigma(s_i) > w^\Sigma(s_j).$$

There exists a contrast parameter $\gamma_\Sigma > 0$ such that

$$\forall s_i, s_j \in \mathcal{S}$$

$$\begin{aligned}
&\Big(u^A(s_i) > u^A(s_j) \wedge u^N(s_i) > u^N(s_j) \\
&\quad \wedge \big(u^A(s_i) - u^A(s_j) = u^N(s_i) - u^N(s_j)\big) \\
&\quad \rightarrow \big(w^A(s_i) - w^A(s_j) > w^N(s_i) - w^N(s_j)\big)\Big).
\end{aligned}$$

In the autistic system,

$$\gamma_A > \gamma_N.$$

Axiom 5 (Intense Processing)**.** Let $D_\Sigma : \mathsf{Stim} \rightarrow \mathsf{Scal}$ denote representational depth in system $\Sigma \in \{A, N\}$. Let $h_\Sigma : \mathsf{Scal} \rightarrow \mathsf{Scal}$ be representational-allocation functions.

For all $s \in \mathcal{S}$,

$$D_\Sigma(s) = h_\Sigma(w^\Sigma(s \mid \mathcal{S})).$$

Representational depth increases with attentional allocation:

$$\forall w_1, w_2 \in \mathsf{Scal}\Big(w_1 > w_2 \rightarrow h_\Sigma(w_1) \geq h_\Sigma(w_2)\Big).$$

Moreover, there exists $w_0 \in \mathsf{Scal}$ such that $0 < w_0 < 1$, and

$$\forall w_1, w_2 \in \mathsf{Scal}\Big(w_1 \geq w_0 \wedge w_2 \geq w_0 \wedge w_1 > w_2 \rightarrow [h_A(w_1) - h_A(w_2)] > [h_N(w_1) - h_N(w_2)]\Big).$$

Axiom 6 (Validation)**.** Let Model denote the sort of internal models. Let $\mathcal{L}_\Sigma : \mathsf{Model} \to \mathsf{Scal}$ denote inconsistency evaluation functions, and let $\mathcal{R}_\Sigma : \mathsf{Model} \to \mathsf{Scal}$ denote intersubjective mismatch evaluation functions. Let $J_\Sigma : \mathsf{Model} \to \mathsf{Scal}$ denote validation functions, and let $\succ_\Sigma$ denote a validation preference relation over Model.

For all $K \in \mathsf{Model}$,

$$J_\Sigma(K) = \lambda_\Sigma \, \mathcal{L}_\Sigma(K) + \mu_\Sigma \, \mathcal{R}_\Sigma(K),$$

where $\lambda_\Sigma, \mu_\Sigma \geq 0$.

Validation prefers models with lower validation score:

$$\forall K_1, K_2 \in \mathsf{Model}\Big(J_\Sigma(K_1) < J_\Sigma(K_2) \to K_1 \succ_\Sigma K_2\Big).$$

In the autistic system,

$$\exists c > 1 \quad \lambda_A \geq c \, \mu_A.$$

Axiom 7 (Integration)**.** Let $K_\Sigma, \widetilde{K}_\Sigma, K_\Sigma^+ \in \mathsf{Model}$ denote the prior model state, stimulus-driven update, and integrated model state. Let $F_\Sigma : \mathsf{Model} \times \mathsf{Model} \to \mathsf{Model}$ be an integration function $K_\Sigma^+ = F_\Sigma(K_\Sigma, \widetilde{K}_\Sigma)$. Let $\eta_A, \eta_N \in \mathsf{Scal}$ denote relative prior influence.

Hold

$$\eta_A < \eta_N.$$

Axiom 8 (Motivation)**.** Let $I, E : \mathsf{Model} \to \mathsf{Scal}$ denote intrinsic and extrinsic reward functions. Let $M_\Sigma : \mathsf{Model} \to \mathsf{Scal}$ denote motivational valuation functions for $\Sigma \in \{A, N\}$.

For all $K \in \mathsf{Model}$,

$$M_\Sigma(K) = \alpha_\Sigma I(K) + \beta_\Sigma E(K),$$

where $\alpha_\Sigma, \beta_\Sigma \geq 0$.

In the autistic system,

$$\exists c > 1 \quad \alpha_A \geq c \, \beta_A.$$

For all $K_1, K_2 \in \mathsf{Model}$,

$$K_1 \succ_\Sigma K_2 \Longleftrightarrow I(K_1) > I(K_2).$$

4.3.3 Interpreted realization of $\mathcal{A}$

The interpreted system

$$\mathcal{A}^{\mathcal{I}}$$

constitutes one admissible realization of the abstract axiomatic theory $\mathcal{A}$.

The abstract theory $\mathcal{A}$ specifies structural relations between cognitive mechanisms, while the interpreted system $\mathcal{A}^{\mathcal{I}}$ provides one concrete analytic realization of these relations over real-valued domains.

The following interpreted axioms assign cognitive and analytic meaning to the non-logical symbols of the abstract theory.

Under the interpretation $\mathcal{I}$, the stimulus domain Stim is interpreted as the set of perceptually available stimuli, while the function

$$x_\Sigma : \mathsf{Stim} \to \mathbb{R}$$

is interpreted as the centrally represented signal magnitude associated with stimulus s in cognitive system Σ.

The relation $x_A(s) \geq x_N(s)$ is interpreted as increased centrally represented signal strength in the autistic system relative to the non-autistic system.

Under the interpretation $\mathcal{I}$, the feature spaces

$$\mathsf{Feat}_I = \mathbb{R}^{d_I}, \qquad \mathsf{Feat}_S = \mathbb{R}^{d_S},$$

are interpreted such that the combined feature representation may be identified with

$$\phi(s) = (\phi_I(s), \phi_S(s)) \in \mathbb{R}^{d_I} \times \mathbb{R}^{d_S}.$$

The abstract function symbols f_A, f_N are instantiated as differentiable real-valued functions over scalar domains. Monotonicity relations from the abstract theory are therefore represented analytically through partial derivative constraints.

Attentional allocation is modeled through normalized exponential weighting (softmax selection), providing one admissible analytic realization of the abstract competitive allocation structure.

Representational allocation functions are assumed differentiable, allowing representational sensitivity to attentional allocation to be expressed analytically through derivative relations.

Validation preference relations are instantiated through minimization of weighted objective functions over internal model states.

Model integration is instantiated through weighted combination of prior global state and stimulus-driven update.

Within the interpreted realization, motivational valuation is modeled as a weighted combination of intrinsic and extrinsic reward functions.

This interpreted realization extends the abstract first-order structure with analytic operators over real-valued domains, including differentiation, normalization, optimization, and exponential weighting functions.

Interpreted Axiom 1 (Input Gain)**.** Let $\mathcal{S}$ denote a set of concurrent stimuli, with $s \in \mathcal{S}$. Let $\Sigma \in \{A, N\}$ denote cognitive systems, where A represents the autistic system and N the non-autistic system. Let $x_\Sigma : \mathsf{Stim} \to \mathbb{R}$ denote the centrally represented signal magnitude associated with stimulus s in system Σ. Here, centrally represented refers to a stimulus having been mapped from peripheral sensory space into an internally encoded scalar magnitude within the central nervous system.

It holds that

$$x_A(s) \geq x_N(s)$$

for all $s \in \mathcal{S}$, with strict inequality for at least one stimulus.

Interpreted Axiom 2 (Salience Allocation)**.** Let $\phi : \mathsf{Stim} \to \mathbb{R}^{d_I} \times \mathbb{R}^{d_S}$, $\phi(s) = (\phi_I(s), \phi_S(s))$ denote the feature representation of stimulus s, decomposed into intrinsic (I) and social (S) components. Define u_{sal} as the salience component of total attentional utility.

Let $g_I : \mathbb{R}^{d_I} \to \mathbb{R}, g_S : \mathbb{R}^{d_S} \to \mathbb{R}$ denote feature evaluation mappings.

There exist nonnegative weights $(\beta_I^\Sigma(s), \beta_S^\Sigma(s)), \Sigma \in \{A, N\}$, such that $\beta_I^\Sigma(s) + \beta_S^\Sigma(s) = 1$, and

$$u_{\mathrm{sal}}^\Sigma(s) = \beta_I^\Sigma(s)\, g_I(\phi_I(s)) + \beta_S^\Sigma(s)\, g_S(\phi_S(s)).$$

If $g_I(\phi_I(s)) > 0$ and $g_S(\phi_S(s)) > 0$, then in the autistic system,

$$\beta_I^A(s) > \beta_S^A(s),$$

while in the non-autistic system,

$$\beta_S^N(s) \geq \beta_I^N(s).$$

Interpreted Axiom 3 (Priority Modulation)**.** Let $T : \mathcal{S} \to \mathbb{R}_{\geq 0}$ denote the time of central representation of stimulus s, measured relative to the onset of the current stimulus set. Define $\Delta T(s) = t_{\mathrm{now}} - T(s)$ as the age of stimulus s since central encoding. Let $\kappa : \mathcal{S} \to \mathbb{R}_{\geq 0}$ denote the context-driven urgency of stimulus s, quantifying its potential to trigger global attentional reallocation. Define u_{pri} as the priority component of total attentional utility.

There exists a function f_A such that

$$u_{\mathrm{pri}}^A(s) = f_A(\Delta T(s), \kappa(s)),$$

with

$$\frac{\partial f_A}{\partial \Delta T} < 0, \qquad \frac{\partial f_A}{\partial \kappa} > 0.$$

There exists $\theta > 0$ such that

$$\kappa(s_i), \kappa(s_j) < \theta \wedge \Delta T(s_i) < \Delta T(s_j) \Rightarrow u^A_{\text{pri}}(s_i) > u^A_{\text{pri}}(s_j),$$

and

$$\kappa(s_i) \geq \theta \wedge \kappa(s_j) < \theta \Rightarrow u^A_{\text{pri}}(s_i) > u^A_{\text{pri}}(s_j).$$

There exists a function f_N such that

$$u^N_{\text{pri}}(s) = f_N(\Delta T(s), \kappa(s), c(s)),$$

where $c(s)$ denotes contextual relevance.

Interpreted Axiom 4 (Attentional Gain)**.** The total utility of stimulus s is given by

$$u^\Sigma(s) = u^\Sigma_{\text{sal}}(s) \cdot \big(1 + u^\Sigma_{\text{pri}}(s)\big).$$

Attentional weights arise from normalized selection scores via

$$w^\Sigma(s \mid \mathcal{S}) = \frac{\exp\big(\gamma_\Sigma u^\Sigma(s)\big)}{\sum_{s' \in \mathcal{S}} \exp\big(\gamma_\Sigma u^\Sigma(s')\big)},$$

where

$$\gamma_\Sigma > 0.$$

The autistic system exhibits elevated competitive contrast:

$$\gamma_A > \gamma_N.$$

Interpreted Axiom 5 (Intense Processing)**.** Let $D_\Sigma(s)$ denote the representational depth of stimulus s in system Σ. Representational depth is an increasing function of attentional allocation:

$$D_\Sigma(s) = h_\Sigma\big(w^\Sigma(s \mid \mathcal{S})\big), \qquad h'_\Sigma(w) \geq 0.$$

Moreover, there exists $w_0 \in (0, 1)$ such that for all $w \geq w_0$,

$$h'_A(w) > h'_N(w).$$

Interpreted Axiom 6 (Validation)**.** Let K_Σ denote the internal global model of the environment maintained by system Σ. Let $\mathcal{L}_\Sigma(K; \text{data})$ measure the internal inconsistency of model K with respect to processed data, and let $\mathcal{R}_\Sigma(K; \text{others})$ measure mismatch to intersubjective alignment constraints.

Validation selects models by minimizing the weighted objective

$$J_\Sigma(K) = \lambda_\Sigma \, \mathcal{L}_\Sigma(K; \text{data}) + \mu_\Sigma \, \mathcal{R}_\Sigma(K; \text{others}),$$

where

$$\lambda_\Sigma, \mu_\Sigma \geq 0.$$

In the autistic system, there exists a constant $c_\lambda > 1$ such that

$$\lambda_A \geq c_\lambda \mu_A.$$

Interpreted Axiom 7 (Integration)**.** Let $\widetilde{K}_\Sigma(\mathcal{S})$ denote the stimulus-driven update obtained from processing the stimulus set $\mathcal{S}$.

Model integration combines prior state and stimulus-driven evidence via

$$K_\Sigma^+ = (1 - \eta_\Sigma) \, \widetilde{K}_\Sigma(\mathcal{S}) + \eta_\Sigma \, K_\Sigma,$$

where $\eta_\Sigma \in [0, 1]$ determines the strength of prior influence.

In the autistic system,

$$\eta_A < \eta_N.$$

Interpreted Axiom 8 (Motivation)**.** Let $I(K)$ denote intrinsic reward associated with improvement of internal model coherence, and let $E(K)$ denote extrinsic reward associated with social evaluation or external incentives.

Motivational drive governing allocation of cognitive effort is given by

$$M_\Sigma = \alpha_\Sigma I(K) + \beta_\Sigma E(K), \qquad \alpha_\Sigma, \beta_\Sigma \geq 0.$$

In the autistic system, there exists a constant $c_\alpha > 1$ such that

$$\alpha_A \geq c_\alpha \beta_A.$$

4.3.4 Universal axioms $\mathcal{U}$

Universal Axiom 1 (Attentional Normalization)**.** For every system $\Sigma \in \{A, N\}$ and every concurrent stimulus set $\mathcal{S} \subseteq \mathsf{Stim}$,

$$\sum_{s \in \mathcal{S}} w^\Sigma(s) = 1.$$

Universal Axiom 2 (Capacity Constraint)**.** There exists a constant $C > 0$ such that for every system $\Sigma \in \{A, N\}$ and every concurrent stimulus set $\mathcal{S} \subseteq \mathsf{Stim}$, the total representational depth is bounded by

$$\sum_{s \in \mathcal{S}} D_\Sigma(s) \leq C.$$

Chapter 5

Properties of the Axiomatic System

The proposed axiomatic system is intended to provide an essential mechanistic description of autistic cognitive processing. The framework is designed to define a set of formal principles that a cognitive system must satisfy to be considered autistic.

The system is not intended to function as a concurrent model alongside existing frameworks (see those listed in Section 1.5). Rather, it operates at a higher level of abstraction from which particular models may be constructed through interpretation.

By interpretation, we mean the model-theoretic process of assigning semantic content to the symbols of an abstract theory formulated in a formal logical language containing initially uninterpreted function symbols, relation symbols, and constants.

The framework is intended to be referential rather than purely comparative, explicitly formalizing differences between autistic and allistic cognition. At the same time, it is assumed that real cognitive systems operate through varying combinations of these processing tendencies rather than occupying pure extremes. Purely autistic or purely allistic modes of computation are therefore expected to be rare in practice, with cognition typically reflecting mixtures of both organizational patterns.

Clinical diagnoses of autism spectrum conditions are interpreted as arising when the cumulative expression of autistic processing tendencies exceeds a critical threshold, even though the individual mechanisms themselves are not pathological in isolation.

An evaluation of the proposed system from both conceptual and formal perspectives is provided below.

Independence proofs are carried out relative to the abstract axiom set A, while the universal axioms U are assumed fixed background constraints.

5.1 Formal properties

To assess the adequacy of the axiomatic system, we consider several standard criteria (see Section 4.1). Note that while the formalism admits systems indexed by $\Sigma \in$

$\{A, N\}$, the present work focuses on the autistic instance $\Sigma = A$, leaving a detailed description of the allistic case for future investigation.

Formal proofs of consistency and independence are carried out with respect to the abstract theory $\mathcal{A}$, while the interpreted realization $\mathcal{A}^{\mathcal{I}}$ serves as one witness model.

5.1.1 Consistency

By the Gödel completeness theorem for first-order logic,

$$\mathcal{A} \nvdash \bot \quad \iff \quad \exists \mathcal{M} \models \mathcal{A}.$$

Thus, consistency of the system may be established by exhibiting at least one admissible model satisfying all axioms simultaneously.

Model construction

To establish consistency of the axiomatic system, it suffices to exhibit at least one interpretation under which all axioms are simultaneously satisfied.

Theorem 1. The interpreted system $\mathcal{A}^{\mathcal{I}}$ is a model of the abstract axiom set $\mathcal{A}$. That is,

$$\mathcal{A}^{\mathcal{I}} \models \mathcal{A}.$$

Consequently, the axiomatic system $\mathcal{A}$ is consistent.

Proof. Under the interpretation $\mathcal{I}$, the abstract domains are assigned concrete semantic domains. The stimulus sort Stim is interpreted as a set of perceptually available stimuli, while the scalar sort Scal is interpreted as the real-valued scalar domain

$$\mathsf{Scal}^{\mathcal{I}} = \mathbb{R}.$$

The feature domains are interpreted as

$$\mathsf{Feat}_I^{\mathcal{I}} = \mathbb{R}^{d_I}, \qquad \mathsf{Feat}_S^{\mathcal{I}} = \mathbb{R}^{d_S},$$

and the model sort Model is interpreted as a domain of internal model states.

The function symbols

$$x_\Sigma, \phi_I, \phi_S, g_I, g_S, u^\Sigma_{\text{sal}}, u^\Sigma_{\text{pri}}, u^\Sigma, w^\Sigma, h_\Sigma, \mathcal{L}_\Sigma, \mathcal{R}_\Sigma, J_\Sigma, F_\Sigma, M_\Sigma$$

are assigned the corresponding functions specified in the interpreted axiom set $\mathcal{A}^{\mathcal{I}}$.

The Input Gain axiom is satisfied under the interpretation $\mathcal{I}$, since the interpreted system specifies

$$x_A(s) \geq x_N(s)$$

for all $s \in \mathcal{S}$, with strict inequality for at least one stimulus, exactly as required by the abstract axiom.

The Salience Allocation axiom is satisfied under the interpretation $\mathcal{I}$, because the interpreted formulation instantiates the relation

$$u^{\Sigma}_{\text{sal}}(s) = \beta^{\Sigma}_{I}(s) g_I(\phi_I(s)) + \beta^{\Sigma}_{S}(s) g_S(\phi_S(s)),$$

subject to $\beta^{\Sigma}_{I}(s) + \beta^{\Sigma}_{S}(s) = 1$, $\beta^{\Sigma}_{I}(s), \beta^{\Sigma}_{S}(s) \geq 0$, and further specifies

$$\beta^{A}_{I}(s) > \beta^{A}_{S}(s), \qquad \beta^{N}_{S}(s) \geq \beta^{N}_{I}(s)$$

whenever both intrinsic and social feature evaluations are positive. These conditions coincide with those required by the abstract axiom.

The Priority Modulation axiom is satisfied under the interpretation $\mathcal{I}$, because the interpreted formulation realizes the abstract priority function through

$$u^{A}_{\text{pri}}(s) = f_A(\Delta T(s), \kappa(s)),$$

with

$$\frac{\partial f_A}{\partial \Delta T} < 0, \qquad \frac{\partial f_A}{\partial \kappa} > 0.$$

These conditions instantiate the required decrease of priority with stimulus age and increase with contextual urgency. The interpreted formulation further preserves the threshold condition through the existence of a constant

$$\theta > 0,$$

under which sufficiently urgent stimuli dominate lower-urgency stimuli, as required by the abstract axiom.

The Attentional Gain axiom is satisfied under the interpretation $\mathcal{I}$, because the interpreted formulation instantiates the abstract utility relation

$$u^{\Sigma}(s) = u^{\Sigma}_{\text{sal}}(s)\big(1 + u^{\Sigma}_{\text{pri}}(s)\big)$$

and realizes attentional allocation through normalized exponential weighting. This realization preserves the required ordering between utility and attentional allocation and introduces the contrast parameter γ_Σ. Since

$$\gamma_A > \gamma_N,$$

the interpreted formulation satisfies the requirement that the autistic system exhibits greater competitive contrast than the non-autistic system.

The Intense Processing axiom is satisfied under the interpretation $\mathcal{I}$, because representational depth is realized as

$$D_\Sigma(s) = h_\Sigma(w^{\Sigma}(s \mid \mathcal{S})),$$

with h_Σ increasing. For sufficiently large attentional weights, the interpreted formulation assumes

$$h'_A(w) > h'_N(w),$$

which implies that increases in attentional allocation produce larger increases in representational depth in the autistic system. Consequently, the abstract depth-allocation condition is satisfied.

The Validation axiom is satisfied under the interpretation $\mathcal{I}$, because the interpreted formulation instantiates the abstract validation function

$$J_\Sigma(K) = \lambda_\Sigma \mathcal{L}_\Sigma(K; \text{data}) + \mu_\Sigma \mathcal{R}_\Sigma(K; \text{others}),$$

with $\lambda_\Sigma, \mu_\Sigma \geq 0$. Furthermore, the interpreted formulation assumes the existence of a constant $c_\lambda > 1$ such that

$$\lambda_A \geq c_\lambda \mu_A.$$

Consequently, internal consistency receives greater relative weight than intersubjective alignment in the autistic system, as required by the abstract axiom.

The Integration axiom is satisfied under the interpretation $\mathcal{I}$, because the interpreted formulation realizes the abstract integration function F_Σ as

$$K_\Sigma^+ = (1 - \eta_\Sigma)\widetilde{K}_\Sigma(\mathcal{S}) + \eta_\Sigma K_\Sigma,$$

where $\eta_\Sigma \in [0, 1]$. Furthermore,

$$\eta_A < \eta_N,$$

so the prior model state contributes less strongly to model integration in the autistic system than in the non-autistic system. This realizes the weaker prior influence required by the abstract axiom.

The Motivation axiom is satisfied under the interpretation $\mathcal{I}$, because the interpreted formulation instantiates the abstract motivational valuation function

$$M_\Sigma(K) = \alpha_\Sigma I(K) + \beta_\Sigma E(K),$$

with $\alpha_\Sigma, \beta_\Sigma \geq 0$. Furthermore, the interpreted formulation assumes the existence of a constant $c_\alpha > 1$ such that

$$\alpha_A \geq c_\alpha \beta_A.$$

Consequently, intrinsic reward receives greater relative weight than externally mediated reward in the autistic system, as required by the abstract axiom.

Therefore every axiom in $\mathcal{A}$ is satisfied under the interpretation $\mathcal{I}$. Hence

$$\mathcal{A}^\mathcal{I} \models \mathcal{A}.$$

Thus the abstract axiom set $\mathcal{A}$ possesses at least one model, namely $\mathcal{A}^\mathcal{I}$.

By the Completeness Theorem,

$$\mathcal{A} \nvdash \bot.$$

Consequently, the axiomatic system $\mathcal{A}$ is consistent.

□

5.1.2 Internal structural coherence

Uniqueness of variable definitions

Each variable appearing in the system is defined through a single primary mechanism. For example, attentional weights $w^{\Sigma}(s|\mathcal{S})$ are uniquely determined by the normalized selection scores specified in the attentional gain axiom, preventing conflicting definitions of the same quantity.

Causal path

The dependencies between variables follow a coherent processing sequence, in which stimulus features determine salience scores, salience determines attentional allocation, attentional allocation determines representational depth, and representation contributes to model integration and validation. This ordered structure prevents circular definitions between variables.

Independence of parameters

Parameter inequalities characterizing autistic processing (e.g. $\gamma_A > \gamma_N, \eta_A < \eta_N, \lambda_A \gg \mu_A$, and $\alpha_A \gg \beta_A$) apply to distinct mechanisms of the system and therefore do not impose mutually incompatible constraints.

5.1.3 Independence

An axiom A_i is independent if $\mathcal{A} \setminus \{A_i\} \nvdash A_i$. By the Soundness Theorem, it therefore suffices to construct a model $\mathcal{M}_i \models \mathcal{A} \setminus \{A_i\}$ such that $\mathcal{M}_i \not\models A_i$.

Independence of Input Gain

Proposition 1. The Input Gain axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_1$ be obtained from the admissible model used in the consistency proof by modifying only the signal magnitude functions.

Let

$$x_A(s) = x_N(s)$$

for all $s \in \mathcal{S}$. Then

$$x_A(s) \geq x_N(s)$$

holds for every stimulus s, but

$$\exists s \in \mathcal{S} \quad x_A(s) > x_N(s)$$

is false. Consequently, the Input Gain axiom is not satisfied in $\mathcal{M}_1$.

The remaining axioms remain satisfiable. In particular, the variables x_A and x_N do not occur in any of the Salience Allocation, Priority Modulation, Attentional Gain, Intense Processing, Validation, Integration, or Motivation axioms. Therefore these axioms may be interpreted exactly as in the admissible model constructed in the consistency proof.

Hence $\mathcal{M}_1 \models \mathcal{A} \setminus \{A_{\text{Input}}\}$, but $\mathcal{M}_1 \not\models A_{\text{Input}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Input}}\} \nvdash A_{\text{Input}}.$$

Therefore the Input Gain axiom is independent. □

Independence of Salience Allocation

Proposition 2. The Salience Allocation axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_2$ be obtained from the admissible model used in the consistency proof by modifying only the autistic salience weights. For every $s \in \mathcal{S}$, set

$$\beta_I^A(s) = \beta_S^A(s) = \frac{1}{2}.$$

Assume that both intrinsic and social feature evaluations are positive, that is,

$$g_I(\phi_I(s)) > 0 \qquad \text{and} \qquad g_S(\phi_S(s)) > 0.$$

Then the condition

$$\beta_I^A(s) > \beta_S^A(s)$$

is false. Hence the Salience Allocation axiom is not satisfied in $\mathcal{M}_2$.

All remaining function symbols, relation symbols, and constants are interpreted as in the admissible model, except that downstream quantities depending on salience are recomputed according to their own defining axioms. In particular, the total utility u^{Σ}, attentional allocation w^{Σ}, and representational depth D_{Σ} are defined using the modified salience values while still satisfying the Attentional Gain and Intense Processing axioms. The Input Gain, Priority Modulation, Validation, Integration, and Motivation axioms are unaffected by this modification.

Therefore, $\mathcal{M}_2 \models \mathcal{A} \setminus \{A_{\text{Salience}}\}$, but $\mathcal{M}_2 \not\models A_{\text{Salience}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Salience}}\} \nvdash A_{\text{Salience}}.$$

Thus the Salience Allocation axiom is independent. □

Independence of Priority Modulation

Proposition 3. The Priority Modulation axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_3$ be obtained from the admissible model used in the consistency proof by modifying only the autistic priority function. Define

$$u^{A}_{\text{pri}}(s) = \Delta T(s) + \kappa(s).$$

Assume that there exist stimuli $s_i, s_j \in \mathcal{S}$ such that

$$\Delta T(s_i) < \Delta T(s_j) \qquad \text{and} \qquad \kappa(s_i) = \kappa(s_j).$$

Then we obtain

$$u^{A}_{\text{pri}}(s_i) < u^{A}_{\text{pri}}(s_j).$$

This contradicts the Priority Modulation axiom, which requires

$$u^{A}_{\text{pri}}(s_i) > u^{A}_{\text{pri}}(s_j)$$

under the same conditions. Hence the Priority Modulation axiom is not satisfied in $\mathcal{M}_3$.

All remaining function symbols, relation symbols, and constants are interpreted as in the admissible model, except that downstream quantities depending on priority are recomputed according to their own defining axioms. In particular, the total utility u^{Σ}, attentional allocation w^{Σ}, and representational depth D_{Σ} are defined using the modified priority values while still satisfying the Attentional Gain and Intense Processing axioms. The Input Gain, Salience Allocation, Validation, Integration, and Motivation axioms are unaffected by this modification.

Therefore, $\mathcal{M}_3 \models \mathcal{A} \setminus \{A_{\text{Priority}}\}$, but $\mathcal{M}_3 \not\models A_{\text{Priority}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Priority}}\} \nvdash A_{\text{Priority}}.$$

Thus the Priority Modulation axiom is independent. □

Independence of Attentional Gain

Proposition 4. The Attentional Gain axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_4$ be obtained from the admissible model used in the consistency proof by modifying only the attentional allocation mechanism. Set

$$\gamma_A = \gamma_N.$$

Assume that there exist stimuli $s_i, s_j \in \mathcal{S}$ such that

$$u^A(s_i) > u^A(s_j), \qquad u^N(s_i) > u^N(s_j),$$

and

$$u^A(s_i) - u^A(s_j) = u^N(s_i) - u^N(s_j).$$

Define the attentional allocation functions so that

$$w^A(s_i) - w^A(s_j) = w^N(s_i) - w^N(s_j).$$

Then the required strict inequality

$$w^A(s_i) - w^A(s_j) > w^N(s_i) - w^N(s_j)$$

fails. Moreover, the condition

$$\gamma_A > \gamma_N$$

also fails. Hence the Attentional Gain axiom is not satisfied in $\mathcal{M}_4$.

All remaining function symbols, relation symbols, and constants are interpreted as in the admissible model, except that downstream quantities depending on attentional allocation are recomputed according to their own defining axioms. In particular, representational depth D_Σ is defined from the resulting attentional weights as required by the Intense Processing axiom. The Input Gain, Salience Allocation, Priority Modulation, Validation, Integration, and Motivation axioms are unaffected by this modification.

Therefore, $\mathcal{M}_4 \models \mathcal{A} \setminus \{A_{\text{Attention}}\}$, but $\mathcal{M}_4 \not\models A_{\text{Attention}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Attention}}\} \nvdash A_{\text{Attention}}.$$

Thus the Attentional Gain axiom is independent. □

Independence of Intense Processing

Proposition 5. The Intense Processing axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_5$ be obtained from the admissible model used in the consistency proof by modifying only the representational-allocation functions. Define

$$h_A = h_N.$$

Assume that there exist $w_1, w_2 \in \mathsf{Scal}$ such that

$$w_1 \geq w_0, \qquad w_2 \geq w_0, \qquad w_1 > w_2.$$

Then

$$h_A(w_1) - h_A(w_2) = h_N(w_1) - h_N(w_2).$$

Therefore the required strict inequality

$$[h_A(w_1) - h_A(w_2)] > [h_N(w_1) - h_N(w_2)]$$

is false. Hence the Intense Processing axiom is not satisfied in $\mathcal{M}_5$.

All remaining function symbols, relation symbols, and constants are interpreted as in the admissible model, except that D_Σ is recomputed according to the modified representational-allocation functions. The Input Gain, Salience Allocation, Priority Modulation, Attentional Gain, Validation, Integration, and Motivation axioms are unaffected by this modification.

Therefore, $\mathcal{M}_5 \models \mathcal{A} \setminus \{A_{\text{Depth}}\}$, but $\mathcal{M}_5 \not\models A_{\text{Depth}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Depth}}\} \nvdash A_{\text{Depth}}.$$

Thus the Intense Processing axiom is independent. □

Independence of Validation

Proposition 6. The Validation axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_6$ be obtained from the admissible model used in the consistency proof by modifying only the validation weights. Set

$$\lambda_A = \mu_A > 0.$$

Then there does not exist any constant $c > 1$ such that

$$\lambda_A \geq c\mu_A.$$

Indeed, since $\lambda_A = \mu_A$, the inequality would require

$$\mu_A \geq c\mu_A,$$

which is impossible for $\mu_A > 0$ and $c > 1$. Hence the Validation axiom is not satisfied in $\mathcal{M}_6$.

All remaining function symbols, relation symbols, and constants are interpreted as in the admissible model. The Input Gain, Salience Allocation, Priority Modulation, Attentional Gain, Intense Processing, Integration, and Motivation axioms are unaffected by this modification.

Therefore, $\mathcal{M}_6 \models \mathcal{A} \setminus \{A_{\text{Validation}}\}$, but $\mathcal{M}_6 \not\models A_{\text{Validation}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Validation}}\} \nvdash A_{\text{Validation}}.$$

Thus the Validation axiom is independent. □

Independence of Integration

Proposition 7. The Integration axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_7$ be obtained from the admissible model used in the consistency proof by modifying only the prior-influence parameters. Set

$$\eta_A = \eta_N.$$

Then the condition

$$\eta_A < \eta_N$$

is false. Hence the Integration axiom is not satisfied in $\mathcal{M}_7$.

All remaining function symbols, relation symbols, and constants are interpreted as in the admissible model. The Input Gain, Salience Allocation, Priority Modulation, Attentional Gain, Intense Processing, Validation, and Motivation axioms are unaffected by this modification.

Therefore, $\mathcal{M}_7 \models \mathcal{A} \setminus \{A_{\text{Integration}}\}$, but $\mathcal{M}_7 \not\models A_{\text{Integration}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Integration}}\} \nvdash A_{\text{Integration}}.$$

Thus the Integration axiom is independent. □

Independence of Motivation

Proposition 8. The Motivation axiom is independent of the remaining axioms of $\mathcal{A}$.

Proof. Let $\mathcal{M}_8$ be obtained from the admissible model used in the consistency proof by modifying only the motivational weights. Set

$$\alpha_A = \beta_A > 0.$$

Then there does not exist any constant $c_\alpha > 1$ such that

$$\alpha_A \geq c_\alpha \beta_A.$$

Indeed, since $\alpha_A = \beta_A$, the inequality would require

$$\beta_A \geq c_\alpha \beta_A,$$

which is impossible for $\beta_A > 0$ and $c_\alpha > 1$.

Hence the Motivation axiom is not satisfied in $\mathcal{M}_8$.

All remaining function symbols, relation symbols, and constants are interpreted as in the admissible model. The Input Gain, Salience Allocation, Priority Modulation, Attentional Gain, Intense Processing, Validation, and Integration axioms are unaffected by this modification.

Therefore, $\mathcal{M}_8 \models \mathcal{A} \setminus \{A_{\text{Motivation}}\}$, but $\mathcal{M}_8 \not\models A_{\text{Motivation}}$.

By the Soundness Theorem,

$$\mathcal{A} \setminus \{A_{\text{Motivation}}\} \nvdash A_{\text{Motivation}}.$$

Thus the Motivation axiom is independent. □

5.1.4 Generativity

Generativity is demonstrated in Chapter 6 by deriving a collection of theorems from the abstract axiomatic system.

The present derivations represent only a limited subset of the consequences potentially generated by the framework. In particular, the derivation of results concerning monotropism, exclusive attentional allocation, and other properties involving attentional weighting would require the universal axioms to be reformulated in first-order language and incorporated into the joint theory

$$\mathcal{T} = \mathcal{A} \cup U.$$

Alternatively, such consequences may be derived from the interpreted realization of the system $\mathcal{A}$. These directions are left for future investigation, as their development exceeds the scope of the present work.

Chapter 6

Theorems

Lemma 1 (Representational Amplification)**.** Let $w_1, w_2 \in \mathsf{Scal}$.

If

$$w_1 \geq w_0, \qquad w_2 \geq w_0, \qquad w_1 > w_2,$$

then

$$[h_A(w_1) - h_A(w_2)] > [h_N(w_1) - h_N(w_2)].$$

Consequently, identical attentional contrasts induce greater representational differentiation in the autistic system than in the non-autistic system.

Proof. The result follows directly from the final clause of the Intense Processing axiom. □

Theorem 2 (Enhanced representational differentiation)**.** Let $s_i, s_j \in \mathcal{S}$. Assume

$$u^A(s_i) > u^A(s_j), \qquad u^N(s_i) > u^N(s_j),$$

and

$$u^A(s_i) - u^A(s_j) = u^N(s_i) - u^N(s_j).$$

Assume further that

$$w^A(s_i) \geq w_0, \qquad w^A(s_j) \geq w_0.$$

Then equal utility contrasts induce stronger attentional contrast in the autistic system, and this contrast is transformed into stronger representational differentiation by the intense-processing mechanism.

Proof. By the Attentional Gain axiom, the assumptions

$$u^A(s_i) > u^A(s_j), \qquad u^N(s_i) > u^N(s_j),$$

and

$$u^A(s_i) - u^A(s_j) = u^N(s_i) - u^N(s_j)$$

imply

$$w^A(s_i) - w^A(s_j) > w^N(s_i) - w^N(s_j).$$

Hence, equal utility contrasts induce a stronger attentional contrast in the autistic system.

Since

$$w^A(s_i) \geq w_0, \qquad w^A(s_j) \geq w_0,$$

the preceding lemma applies to the attentional values

$$w_1 = w^A(s_i), \qquad w_2 = w^A(s_j).$$

Therefore, the attentional contrast generated in the autistic system is transformed into a larger representational difference than would be induced by the same attentional contrast in the non-autistic system.

Consequently, equal utility contrasts lead to enhanced representational differentiation in the autistic system. □

Theorem 3 (Intrinsic Motivational Dominance)**.** Let $K_1, K_2 \in \mathsf{Model}$. Assume

$$K_1 \succ_A K_2,$$

and suppose that the intrinsic reward advantage of K_1 equals the extrinsic reward advantage of K_2:

$$I(K_1) - I(K_2) = E(K_2) - E(K_1) > 0.$$

Then

$$M_A(K_1) > M_A(K_2).$$

Proof. By the Motivation axiom,

$$M_A(K) = \alpha_A I(K) + \beta_A E(K),$$

where $\alpha_A, \beta_A \geq 0$. Moreover, in the autistic system,

$$\exists c > 1 \quad \alpha_A \geq c\beta_A.$$

Hence

$$\alpha_A > \beta_A.$$

Now,

$$M_A(K_1) - M_A(K_2) = \alpha_A\big(I(K_1) - I(K_2)\big) + \beta_A\big(E(K_1) - E(K_2)\big).$$

Since

$$I(K_1) - I(K_2) = E(K_2) - E(K_1) > 0,$$

let

$$\delta = I(K_1) - I(K_2) = E(K_2) - E(K_1).$$

Then

$$E(K_1) - E(K_2) = -\delta.$$

Therefore,

$$M_A(K_1) - M_A(K_2) = \alpha_A\delta - \beta_A\delta = (\alpha_A - \beta_A)\delta.$$

Since $\alpha_A > \beta_A$ and $\delta > 0$, we obtain

$$M_A(K_1) - M_A(K_2) > 0.$$

Therefore,

$$M_A(K_1) > M_A(K_2).$$

□

6.1 Interpretation

6.1.1 Representational amplification

Formal result.

Above the attentional threshold w_0, identical attentional contrasts produce larger representational contrasts in the autistic system than in the non-autistic system.

Psychological interpretation.

The findings suggest that when attention is intensely directed toward a specific set of stimuli, the autistic cognitive system may preserve more nuanced distinctions among them. Moreover, information receiving comparable levels of attention may be represented with greater internal differentiation instead of being consolidated into broader categories.

At the cognitive level, this may contribute both to increased representational granularity, heightened sensitivity to subtle structural differences, and enhanced detection of inconsistencies (see Section 3.2.1). At the phenomenological level, it may correspond to the subjective experience that distinctions that appear negligible to others remain salient and meaningful in the autistic case, consistent with our expectations.

6.1.2 Enhanced representational differentiation

Formal result.

Even when two stimuli differ by the same amount in perceived importance, the autistic system tends to separate them more strongly in attention. This difference is subsequently amplified during processing, resulting in more distinct cognitive representations.

Psychological interpretation.

This theorem suggests that differences in perceived importance between competing stimuli may become magnified during processing.

Consequently, relatively small differences in perceived importance may translate into substantially larger differences in attentional allocation and subsequent representation.

This mechanism may contribute to detail-oriented cognition, sustained focus on selected information, and increased pattern sensitivity (see Section 3.2.1). More generally, it provides a formal route through which relatively small differences in perceived importance may propagate into substantial differences in cognitive representation.

6.1.3 Intrinsic motivational dominance

Formal result.

When two models provide equal total reward differences, but one derives its advantage from internal validation while the other derives its advantage from external reward, the internally validated model becomes motivationally dominant in the autistic system.

Psychological interpretation.

This theorem translates to the fact that internally coherent representations may remain motivationally attractive in the autistic system even when competing alternatives receive greater social approval or external reinforcement. Because intrinsic reward contributes more strongly to motivation than extrinsic reward, internally validated interests may continue to guide motivational engagement despite conflicting external incentives.

At the cognitive level, this may contribute to autonomous cognition and reduced dependence on social consensus during reasoning (see Section 3.2.1). Over longer timescales, it may provide a mechanism for the persistence of highly individualized interests, prolonged engagement with self-selected domains of inquiry, and resistance to abandoning internally coherent models solely on the basis of external pressure.

6.1.4 Summary

The preceding results illustrate the generative capacity of the proposed axiomatic framework. Starting from a small set of primitive assumptions, the system produces non-trivial consequences concerning representational differentiation and motivational dynamics in autistic cognition.

Importantly, the derived results correspond to higher-level cognitive tendencies previously introduced at the cognitive-dynamic and emergent levels of description. In particular, the theorems provide formal mechanisms through which increased representational granularity, enhanced pattern sensitivity, autonomous cognition, and persistent intrinsically motivated engagement may arise.

While the present derivations represent only a limited subset of the possible consequences of the theory, they demonstrate that the framework is capable of connecting abstract computational principles to psychologically meaningful properties of cognition.

Conclusion

This thesis aimed to develop an axiomatic framework for describing autistic cognition. Rather than approaching autism as a diagnostic category, the study treated it as one of the computational principles that naturally affect the organisation of cognition. The study sought to identify a small set of abstract principles capable of generating the cognitive tendencies characteristic of the autistic neurotype.

To achieve this goal, an abstract cognitive architecture was proposed and subsequently formalised as an axiomatic system. The resulting framework was shown to possess several desirable formal properties, including consistency, axiom independence, and generative capacity. Furthermore, selected theorems were derived from the system and interpreted in psychological terms, demonstrating how higher-level cognitive tendencies may emerge from interactions among more fundamental principles.

The proposed framework suggests that several commonly described characteristics of autistic cognition may be understood not as isolated phenomena, but as consequences of a shared underlying structure. In this respect, the work represents a shift from phenomenological description toward formal explanation. At the same time, the framework remains preliminary and requires further theoretical refinement and empirical validation before stronger conclusions can be drawn.

The primary contribution of this thesis is therefore methodological and conceptual. It proposes and justifies principles typical of autistic cognition, demonstrating that it can be treated as an object of formal analysis and that axiomatic methods can be applied to the study of neurocognitive variation. More broadly, the work illustrates the important role that mathematical formalisation can play in cognitive science by making assumptions explicit and enabling their consequences to be systematically examined.

While many questions remain unanswered, the current findings imply that an axiomatic approach could offer a valuable basis for future research into the structure of autistic cognition and, potentially, cognition in general.

Chapter 7

Discussion

7.1 Contributions of the framework

The present work proposed an axiomatic framework for describing autistic cognition in relation to allistic cognition. Rather than introducing another process-level cognitive theory, the aim was to identify a small set of minimalist abstract principles from which the cognitive tendencies characteristic of the autistic neurotype could be derived. The resulting framework was shown to possess several desirable formal properties, including consistency, axiom independence, and generative capacity.

A central contribution of the thesis lies in the shift from phenomenological description to the formalization of generating principles. Many existing accounts of autism focus on observable cognitive tendencies, such as detail-oriented processing, sensory sensitivity, enhanced pattern detection, or atypical social cognition. While such descriptions are informative, they do not necessarily explain how these characteristics relate to one another or why they manifest. The present framework addresses this issue by treating these properties as potential consequences of a smaller set of underlying principles, rather than as independent observations.

The derived theorems account for this idea. In particular, the framework generates mechanisms by which increased representational differentiation and intrinsic motivational dominance may emerge from interactions among attentional allocation, processing depth, validation, and motivation, which are proposed to be typical of autistic cognition.

These results are consistent with lower-level descriptions of autism and provide preliminary support for the proposed framework. However, the number of derived theorems in our work is small, and for the theory to be sufficiently confirmed, a much stronger match between its generative capacity and phenomenological description is needed. The reason for this is that the full scope of the theorems that can be generated is beyond the scope of the current goal of this thesis. Our aim was to suggest a reasonable axiomatic system that aligns with existing theories and generative expectations.

7.2 Strengths and limitations

An important strength of the proposed approach is its transparency. All assumptions are stated explicitly and can therefore be examined, criticised, modified or replaced independently. This is in contrast to many verbal theories, where implicit assumptions are often difficult to identify. The axiomatic structure also facilitates comparison with alternative theories, since disagreements can be localised to specific assumptions rather than remaining distributed throughout an entire conceptual framework.

At the same time, however, a limitation should be acknowledged. Some lower-level phenomena discussed in the literature, including monotropism or domain-specific interests, cannot be derived within the present work as this would require further development of the universal component of the theory. This would either require the definition of capacity constraints in first-order language for an abstract system or the acceptance of one possible realisation of the abstract autistic theory, from which further theorems could be derived.

7.3 Empirical validation

The validity of the axiomatic system requires extensive verification. While many theorems may align with empirical reality and serve as explanations for the autistic neurotype, it is sufficient for one theorem to be derived beyond the scope of phenomenological evidence for assumptions to be reconsidered. Therefore, the system may undergo several more iterations of precise calibration to achieve an empirical match. Although the system is internally consistent, wide-ranging external phenomenology might reveal possible gaps.

7.4 Future directions

There are several promising directions for future work. The most immediate extension would be the further development of universal axioms and the derivation of additional theorems.

A later step would be the derivation of theorems at a lower level within an interpreted theory, using specific analytical expectations of formal relationships to generate more precise results.

Another possibility would be to construct quantitative implementations of the framework to allow the simulation and empirical testing of specific predictions.

More broadly, the approach could be extended to a formal description of the neurotype of neurotypical people, thereby extending the scope of cognitive psychology.

We also expect the framework to resolve the ambiguity between disorder-type and cognitive-style autism. We propose that this is a continuous matter of the amount of described patterns, with maladaptation occurring at a threshold amount. However, autism-specific patterns are also significantly present in the general population.

7.5 Conclusion

In conclusion, this thesis demonstrates that autistic cognition can be approached as an object of formal analysis. By expressing assumptions explicitly and examining their consequences through logical derivation, the proposed framework offers a novel perspective on the structure of autistic cognition. While the results are necessarily preliminary, they suggest that the axiomatic method may provide a promising generalisation of the autistic neurotype, thereby enriching cognitive science and autism research.

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