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Linguistic Manifestations of Predictive Coding Error Responses in Psychotic Disorders: An Integrative Review with Neurophysiological Evidence

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Abstract

Introduction: Disturbances in predictive coding are increasingly recognized as core mechanisms shaping perception, cognition, and language in mental disorders. However, the linguistic manifestations of prediction error responses have not been systematically integrated with neurophysiological findings. This review aims to synthesize how different forms of prediction error reactivity are expressed in language and how these patterns correspond to neural signatures.

Material and methods: A scoping review was conducted following PRISMA ScR guidelines, covering empirical and theoretical studies from PubMed and Scopus from 2010 up to 2026. Studies were included if they examined (1) a psychiatric population, (2) predictive coding or prediction error mechanisms, (3) linguistic behavior at any structural level, and (4) behavioral and/or neurophysiological data. Extracted information underwent thematic synthesis using open, axial, and selective coding.

Results: Thirteen publications met the inclusion criteria. Six recurring mechanisms of predictive error responses were identified: heightened prediction error precision, weakened prediction error signalling, impaired sensory-motor prediction, disruptions in hierarchical semantic-pragmatic prediction, deficits in predictive source monitoring, and global predictive instability. Each mechanism was associated with specific linguistic manifestations such as semantic entropy, discourse incoherence, and atypical lexical activation. Concurrently, corresponding neurophysiological indices were observed, including reduced N1/N400 modulation, converging with electrophysiological and neurodynamic evidence.

Conclusions: Language provides a sensitive behavioural window into predictive processing disturbances in mental disorders. The correspondence between linguistic patterns and neurophysiological responses highlights the value of integrative, multilevel approaches for characterizing predictive coding dysfunction in clinical populations. These results suggest that predictive processing deficits occur hierarchically across language levels, producing cascading effects paralleling the clinical course of psychotic illness.

Keywords: predictive coding; prediction error; language; neurophysiology; psychiatry

Streszczenie

Wstęp: Zaburzenia w kodowaniu predykcyjnym są coraz częściej rozpoznawane jako kluczowe mechanizmy kształtujące percepcję, poznanie i język w zaburzeniach psychicznych. Jednak językowe manifestacje reakcji na błąd predykcji nie zostały systematycznie zintegrowane z ustaleniami neurofizjologicznymi. Niniejszy przegląd ma na celu syntezę tego, w jaki sposób różne formy reaktywności na błąd predykcji przejawiają się w języku oraz jak wzorce te odpowiadają sygnałom neuronalnym.

Materiał i metody: Przegląd typu scoping review przeprowadzono zgodnie z wytycznymi PRISMA ScR, obejmując badania empiryczne i teoretyczne z baz PubMed oraz Scopus z lat 2010–2026. Do analiz włączano badania, które spełniały następujące kryteria: (1) dotyczyły populacji psychiatrycznej, (2) badały mechanizmy kodowania predykcyjnego lub błędu predykcji, (3) analizowały zachowania językowe na dowolnym poziomie strukturalnym oraz (4) zawierały dane behawioralne i/lub neurofizjologiczne. Wydobyte informacje poddano syntezie tematycznej z wykorzystaniem kodowania otwartego, aksjalnego i selektywnego.

Dyskusja: Trzydzieści publikacji spełniło kryteria włączenia. Zidentyfikowano sześć mechanizmów reakcji na błąd predykcji: zwiększoną precyzję błędu, osłabione jego sygnalizowanie, zaburzoną predykcję sensomotoryczną, zakłócenia predykcji

semantyczno-pragmatycznej, deficyty monitorowania źródeł oraz globalną niestabilność predykcyjną. Mechanizmy te wiązały się z określonymi manifestacjami językowymi, takimi jak entropia semantyczna, niespójność dyskursu czy atypowa aktywacja leksykalna. Równocześnie obserwowano odpowiadające im wskaźniki neurofizjologiczne, w tym osłabioną modulację N1/N400, zgodne z danymi elektrofizjologicznymi i neurodynamicznymi.

Wnioski: Język stanowi czułe behawioralne okno na zaburzenia przetwarzania predykcyjnego w zaburzeniach psychicznych. Zbieżność między wzorcami językowymi a odpowiedziami neurofizjologicznymi podkreśla wartość zintegrowanych, wielopoziomowych podejść do charakteryzowania dysfunkcji kodowania predykcyjnego w populacjach klinicznych. Wyniki te dodatkowo sugerują, że deficyty przetwarzania predykcyjnego występują hierarchicznie na różnych poziomach języka, prowadząc do efektów kaskadowych, które odzwierciedlają przebieg kliniczny psychozy.

Słowa kluczowe: kodowanie predykcyjne, błąd predykcji, język, neurofizjologia, psychiatria

Abstract

In contemporary cognitive neuroscience, issues of perception and cognition are often framed within the context of predictive processing [1]. From this perspective, *prediction* is understood as the brain's generation of anticipations regarding incoming sensory signals, determined by internal models of the world and previously acquired knowledge. These expectations are formalized as *hypotheses*, i.e., probabilistic representations of the possible causes of sensory inputs [2–4]. They are continuously generated, tested, and updated on the basis of new information. Signals that serve to modify internal models are referred to as *prediction errors*; they represent the discrepancy between predicted and actual sensory inputs [5].

The idea that the brain performs probabilistic inference draws on concepts suggesting that perception reflects Bayesian reasoning aimed at minimizing prediction error [6]. Based on this principle, the brain continuously updates hypotheses about the causes of sensory signals, integrating bottomup and topdown information within a hierarchical structure of generative models [4]. The integration of this approach with research on the neuroanatomical structure of the cerebral cortex, along with its generalization through Karl Friston's freeenergy principle, has enabled the development of the concept of the brain as an active generator of hypotheses [7]. In this view, the brain is not a passive receiver of stimuli but continuously formulates, tests, and updates predictions about the world.

This shift gradually replaced the model of perception understood as the passive reception of stimuli. After the discovery of predictionerror signals (e.g., mismatch negativity – MMN), these views ceased to serve exclusively speculative functions. This marked the beginning of formulating testable research hypotheses [8,9]. Since the turn of the 20th and 21st centuries, the theoretical frameworks of predictive processing models have been increasingly adopted in cognitive neuroscience and

psychiatry [10]. Friston's formulation of the free energy principle, which posits that perception and action can be understood as processes that minimize prediction error, has made it possible to theoretically link brain function with principles from neurobiology, information theory, and the dynamics of complex systems [3,11].

These accounts conceptualize brain function as a process of continuously generating and updating predictions about sensory stimuli and actions. This process occurs while simultaneously minimizing prediction error within hierarchically organized neural networks, that is, interconnected populations of neurons forming layered processing circuits across cortical and subcortical regions [12,13]. In contrast to traditional descriptive models, the predictive approach offers a coherent framework that can explain the heterogeneous symptoms of mental disorders.

In recent years, there has been a systematic increase in studies explaining the transdiagnostic nature of disturbances in the predictivecoding mechanism, described both in the context of psychosis and affective disorders [14–17]. Despite the dynamic development of theoretical models, their clinical operationalization remains limited [18]. In particular, behavioural indicators that would be sufficiently sensitive to subtle deviations in predictive processes, yet feasible for use in clinical practice, are lacking. The inherently predictive and contextdependent nature of linguistic processing suggests a unique potential for linguistic analysis in the study of predictive processing [19].

The human language system based on the sequential and hierarchical organization of phonological, lexicosemantic, syntactic, and prosodic information over time, implies the necessity of continuously predicting subsequent structural units [20] while simultaneously dynamically synchronizing these predictions with social, situational, and pragmatic contexts. These capacities, together with linguistic and communicative competence, are exceptionally sensitive to temporal disturbances and deficits in hierarchical integration [21–23].

Existing empirical findings on schizophasia focus

primarily on qualitative descriptions of narrative disturbances, including, among others, speech disorganization and impairments in narrative coherence [24–27]. Additionally, lexical–semantic disruptions are also reported, such as specific neologisms, metonymies, and disturbances in connotative meaning [28]. These phenomena are rarely situated within consistent neurocognitive frameworks. As a result, the literature devoted to linguistic cognitive prediction remains highly fragmented [29,30]. It lacks systematic concentration on research concerning language in mental disorders from the perspectives of clinical psychiatry, neurolinguistics, and biological approaches.

In light of the above observations, a significant research gap has been identified, manifested in the absence of integrative reviews linking predictive processing models with neurolinguistic analyses of schizophrenic speech. To date, no synthetic accounts have been reported that would allow mapping levels of linguistic organization alongside their susceptibility to predictive disturbances, determining the influence of specific cognitive mechanisms on observed changes, and differentiating whether and how linguistic parameters express the potential to serve as clinical indicators within this scope.

The aim of the present paper is to conduct a scoping review of the literature on linguistic functioning in the context of predictive processing disturbances in psychiatric populations. The hypothesis to be examined is that language exhibits the potential to be treated as a sensitive indicator manifesting dysfunctions of predictive mechanisms through the analysis of responses to prediction errors. This aim will be achieved by: (1) identifying mechanisms of prediction error responses in mental disorders and (2) mapping the corresponding profiles of linguistic features.

Methodology

The organization of mechanisms linking predictive processing disturbances with linguistic behavioural data in psychiatric populations was designed in the form of a scoping review integrated with an analytical theoretical synthesis. The choice of methodological format resulted from the high degree of heterogeneity in the literature, which, in the preliminary assessment, encompassed distinct theoretical paradigms, analysed components of the language system, and clinical populations. The review was conducted in accordance with the PRISMA Extension for Scoping Reviews (PRISMA ScR) guidelines.

The systematic literature search was carried out in the following databases: PubMed and Scopus. To ensure a comprehensive overview, the review included publications from 2010 up to 2026. The search strategy incorporated

both key concepts and their synonyms used in various research approaches. Example keyword filtering involved the following combinations:

“predictive processing” OR “predictive coding” OR “Bayesian inference”

AND

(language OR speech OR prosody OR discourse OR narrative)

AND

(psychiatric disorders OR psychosis)

This search procedure was appropriately adapted to the specificity of each database.

The inclusion criteria comprised peerreviewed empirical or theoretical papers; original studies involving populations diagnosed with a mental disorder; works that included linguistic analysis at at least one level of languagesystem organization; and publications referring to predictive processing models. Exclusion criteria encompassed studies relating exclusively to neurological populations without a significant psychiatric component; purely linguistic works; singlecase studies or anecdotal reports; and publications written in languages other than English.

Before beginning the analysis, duplicates were removed, metadata of the articles (i.e., title, abstract, keywords) were screened, and subsequently full texts were evaluated.

Extraction of data from the publications included in the review encompassed the characterization of the clinical sample, the predictive processing model described, the analysed level of language, the results concerning the relationship between language and predictive processes, and the clinical and/or theoretical implications. This form of data extraction was intended to identify mechanisms rather than symptomatic descriptions.

The methodological and conceptual heterogeneity of the studies included in the review made it impossible to conduct a quantitative metaanalysis. To extract recurring patterns, a narrativethematic synthesis of the data was employed. The main types of predictive disturbances were identified, and the corresponding linguistic parameters were mapped.

The process of categorization and thematic synthesis of the full publications included in the review consisted of three coding stages:

1. **Open coding**, in which detailed extraction of fragments describing predictive processing disturbances, their neurobiological mechanisms, and reported linguistic abnormalities was conducted freely (i.e., without predefined categories);
2. **Axial coding**, in which codes (labels) were grouped into higherorder categories through constant

comparison, assessment of their role in predictive models, and classification within shared levels of the language system;

- 3. Selective (integrative) coding**, in which the previously established categorical structures were iteratively consolidated into clusters of mechanisms based on neurocognitive coherence, linguistic coherence, recurrence (at least two independent references in the literature), and dependence on psychiatric symptoms (consistency of the relation with a given clinical profile). Category labels were assigned descriptively, in accordance with the principles of open coding. [31]

The aim of identifying mechanisms is to organize heterogeneous data rather than to delineate rigid, discrete neurocognitive systems.

The methodological proposal outlined above is intended to enable systematic mapping of the existing literature while maintaining the ability to critically

integrate empirical data with theoretical models. It is designed to support a mechanistic interpretation of language as a dynamic indicator of predictive processing disturbances in mental disorders.

Results

The database search led to the identification of 82 articles, after which duplicates ($n \approx 4$) were removed. Most publications were excluded from the review due to not meeting the criterion of incorporating linguistic analysis as a central variable, or due to their predominant focus on neurological rather than psychiatric disturbances. Ultimately, 13 publications met the inclusion criteria and were incorporated into the final synthesis.

The texts included in the analysis comprised studies involving individuals with schizophrenia ($n \approx 8$), individuals in early psychosis or early stage schizophrenia ($n \approx 2$), and individuals at clinical high risk for psychosis

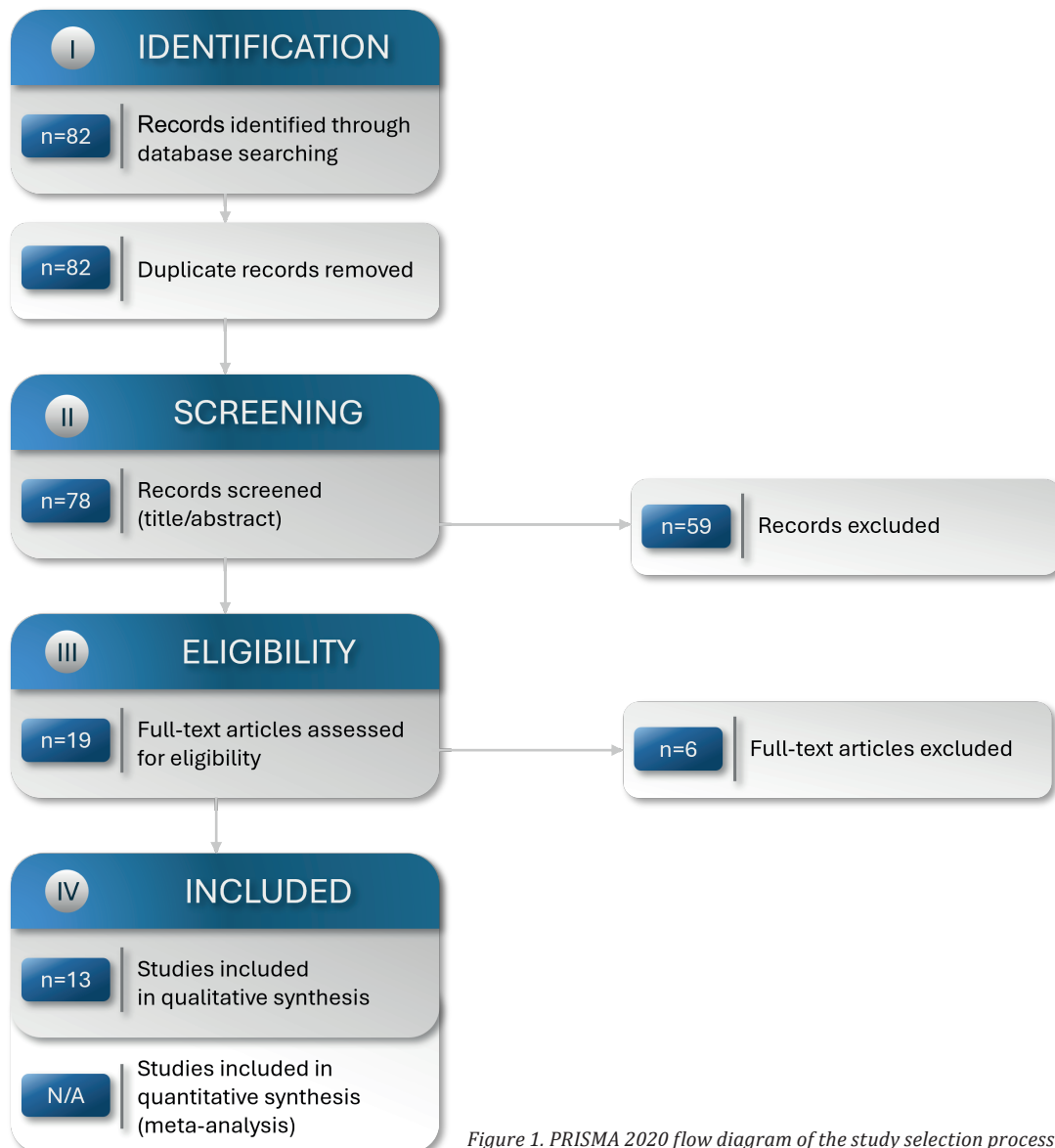


Figure 1. PRISMA 2020 flow diagram of the study selection process

or presenting subclinical psychotic traits ($n \approx 3$). Across these groups, the dataset consisted of empirical studies ($n = 11$) and theoretical papers ($n = 2$)

The literature review enabled the identification of six distinct types of predictive processing disturbances in psychiatry, recognized in the context of linguistic functioning.

Among the publications included in the review, we found reports that used a broad range of experimental and neurophysiological approaches. These included computer-based experimental tasks that manipulated perceptual expectations (e.g., identification of degraded speech, sine-wave/sine-vocoded speech), vocalization paradigms with event-related potentials (ERP) analysis, functional Magnetic Resonance Imaging (fMRI) studies investigating responses to ambiguous speech stimuli, and Bayesian model estimates of the weighting of semantic priors. A key part of this also included behavioral experiments, such as tests of recognition of degraded speech signals, inference tasks about content based on limited sensory input, self-other voice monitoring paradigms, and verbal fluency and discourse organization experiments. that enabled direct observation of changes to the use of predictions and linguistic priors.

Among the reported mechanisms, **excessive signalling of prediction error** was most frequently noted in the group of patients diagnosed with psychotic disorders. Inflexibly high precision of prediction errors involves assigning excessively rigid precision to prediction error signals [32]. As a consequence, minimal discrepancies between the predicted and actual stimulus provoke a perceptual-behavioral response rooted in neuronal activity. Such hyperreactivity, driven by deficits in suppressing unpredictable signals, manifests as a lower threshold for precision errors. At the behavioral level, this is revealed through faster detection of unpredictable stimuli, which elicit a response similar to predictable stimuli. Ultimately, sensory aspects of reality are perceived as overwhelming [32]. At the neurophysiological (oscillatory) level, this phenomenon is associated with a disruption of the balance of neuronal synchronization [33].

At the linguistic level, the semantic aspects of language—grounded in hierarchical predictions of meaning—are particularly sensitive to heightened prediction error signaling. Matsumoto et al. [34] demonstrated that this issue results in the disintegration of semantic structure due to the overactivation of irrelevant associations. Reduction in the amplitude of the N400 (an electrophysiological index of response to semantic conflict), although not specific to prediction processes, reflects impaired updating of meaning representations, which depends on predictive mechanisms and may serve

as a potential biomarker of this mechanism [34]. Improper calibration of linguistic prediction errors results in impaired adaptation of the brain to semantic incongruity.

The mechanism of excessive prediction error signaling, operating at the linguistic level, has most frequently been reported in the context of psychotic disorders. Research on schizophrenia, early psychosis, and schizotypy reveals a consistent pattern of aberrant calibration of prediction error signals and prior expectations, which manifests at both perceptual and semantic levels [35,34]. Consequently, it leads to the overactivation of irrelevant associations and destabilization of meaning processing [33–35], contributing to the characteristic presentation of thought and language disorganization in patients with schizophrenia [36].

The review also enabled the identification of a mechanism manifesting at the level of linguistic and communicative competence, namely **weakened prediction error signalling caused by uncertainty in prediction precision**. This mechanism is primarily related to negative symptoms, described in both psychotic and affective patient groups. In the domain of speech perception, weakened responses to prediction error result in the dominance of the expected signal over sensory data. As a consequence, perception occurs without the involvement of an external stimulus. This mechanism corresponds to reduced amplitude of the mismatch negativity potential and to false speech-in-noise identifications in individuals with auditory hallucinations [37].

Jeganathan and Breakspear [38], examining the negative symptoms of schizophrenia, demonstrated a relationship between engaging in affective behaviour and the processes of predictive evaluation of the social consequences of such behaviour. According to them, advances in describing affective behaviours within the framework of prediction-precision uncertainty are made possible through the implementation of acoustic analyses of speech patterns and accompanying nonverbal cues. Weakened responses to semantic incongruity, the absence of meaning correction during processing, and the loss of flexibility in semantic networks at the level of clinical phenomenology may manifest as loose associations and interpretative rigidity.

The literature on schizophrenia identifies deficits in **hierarchical semantic-pragmatic prediction**, most frequently described at the level of the semantic and pragmatic systems. Overly rigid increases in precision—overestimating the correctness of predictions and disregarding access to new information—impede adaptive updating of meanings, whereas reductions in precision destabilize the interpretation of communicative

and systemic context in the course of psychosis. The degree of predictability and the level of precision in error evaluation, dependent on semantic prediction [39], may be usefully measured through assessments of semantic entropy and semantic surprisal with respect to long-term semantic memory. Disturbed pragmatic predictions are directly associated with increased semantic entropy and with overestimation of the weight of semantic surprisal [40].

Discoordination of predictions across different levels of the language hierarchy leads to disorganization of semantic networks in schizophrenia (characterized by reduced smallworldness, that is, a loss of the typical balance between locally clustered and efficiently interconnected semantic representations [41]) and problems with discourse coherence. In schizophrenia, this manifests as atypical semantic processing in priming and verbal fluency tasks. A weakened N400 response to the aforementioned disorganization, referring to the event-related potential component typically elicited during the processing of semantically incongruent or contextually unexpected linguistic stimuli, is characterized by increased homogenization and reduced representational variability. At the computational level, these deficits result from **improper weighting of prediction error precision** [34].

Publications describing the lack of suppression of sensory responses to one's own speech, leading to difficulties in predicting the consequences of one's own articulation, enabled the identification of a **mechanism of impaired sensorimotor prediction of speech** (efference copy / corollary discharge). These results have emerged mainly from studies carried out in participants with early psychosis and in psychotic disorder samples, where experimentally induced sensorimotor conflict has been shown to interfere with auditory-verbal self-monitoring [42,43]. ERP studies using EEG indicate reduced suppression of cortical responses—specifically diminished N1 suppression, referring to attenuation of the early auditory evoked potential occurring around 100 ms after sound onset—to self-generated speech sounds in individuals with schizophrenia [44]. Previous research involving healthy individuals, a characteristic increase in gamma-band EEG coherence between frontal and temporal lobes was observed during speaking relative to listening activity. This effect was modulated by distorted auditory feedback during speech production. In the group of patients with psychotic disorders, such a pattern was not observed [42].

These findings are not consistent and depend on the experimental paradigm and analytic methods employed. The described cortical response is suppressed less strongly particularly for the early N1 component of

the auditory evoked potential [45]. There are reports demonstrating the involvement of N-methyl-D-aspartate receptor (NMDAR) hypofunction in predictive processing deficits during vocalization in schizophrenia [44]. Weakened suppression of auditory cortex activity in response to self-generated speech sounds, attributed to efference copy mechanisms, is present already in early schizophrenia. Mathalon et al. [43] provide evidence that these alterations precede the onset of psychosis, especially in clinical high-risk groups with increased vulnerability to disturbances in thought content.

At the linguistic level, the mechanism of impaired sensorimotor prediction is described mainly through basic, short-duration analyses of the phonetic-acoustic system. Research concerns the processes of vocalization and speech self-monitoring. In clinical phenomenology, these phenomena are linked to susceptibility to Auditory Verbal Hallucinations (AVH) and to disturbances in self-monitoring, particularly in psychotic disorders.

Research on (self-prediction-based) sense of agency in speech monitoring tasks introduces another level of predictive coding responses into the analysis. **Disturbances of predictive source monitoring** (self-other) represent a mechanism in which prediction errors are not correctly attributed to their source, particularly regarding the internal vs. external origin of utterances, even though the signal itself is processed correctly. This leads to a dissociation between prediction and agency. In schizophrenic speech, this manifests as destabilization in comparing the predicted consequences of one's own speech with the actual auditory feedback. At the cognitive level, this results in misattributing one's own speech as originating externally. Neurophysiological experiments link these deficits to reduced activity and disrupted functional connectivity of the medial prefrontal cortex (mPFC) during speech monitoring and reality monitoring tasks. This is significantly correlated with the severity of auditory-verbal hallucinations in schizophrenia [46].

In the context of predictive processing assumptions, in which the brain generates simulations and subsequently confronts them with incoming signals, source monitoring concerns the capacity to identify whether a given simulation originates from internal generation or external stimulation. Auditory verbal hallucinations, defined as perceptions occurring without sensory stimulation, constitute, according to Thakkar et al. [47], an adaptive cost of imagination, which is a classical account of predictive source attribution error. In this framework, inner speech constitutes a predictively generated linguistic representation. The influence of the mechanism of inducing sensorimotor conflict in clinical groups in early psychosis has been described with regard to the emergence of presence hallucinations and auditory-verbal

“self” monitoring [48].

The obtained results make it possible to map predictive mechanisms identified at the linguistic level onto specific stages of psychotic disorder development. Moreover, they organize the types of prediction error

responses along a hierarchical axis corresponding to the structure of the language system. Table 1, which juxtaposes the identified prediction error mechanisms with the corresponding psychotic disturbances and linguistic deficits, allows these relationships between the

Tab. 1 Predictive Processing Disturbances in Psychotic Disorders and Their Linguistic Manifestations

Type of Predictive Processing Disturbance	Associated Psychiatric Condition (as reported in the reviewed studies)	Linguistic Manifestation
Heightened prediction error precision (HPE) (hyperprecision)	Schizophrenia, schizotypy, early psychosis [34, 35]	Semantics: overactivation of irrelevant associations, disintegration of semantic networks, reduced N400 amplitude, semantic instability
Weakened prediction error signalling (WPE)	Schizophrenia (negative symptoms), affective disorders with psychotic features [37, 38]	Semantics: diminished detection of semantic incongruity, interpretative rigidity, loose associations, language impoverishment
Impaired hierarchical semantic pragmatic prediction (IHP) (misweighted prediction error precision)	Schizophrenia [34, 39, 40, 41]	Semantics + pragmatics: increased semantic entropy, inadequate use of context, discourse level incoherence
Impaired sensory motor prediction (ISM) (efference copy / corollary discharge)	Early psychosis, clinical high risk (CHR), schizophrenia [42–45]	Phonetics / speech control: disrupted speech self monitoring, reduced N1 suppression, susceptibility to auditory verbal hallucinations (AVH)
Predictive source monitoring disturbances (PSM) (self-other attribution)	Schizophrenia, early psychosis [46–48]	Pragmatics / agency in speech: misattribution of the source of utterances, disrupted sense of agency in speech, verbal hallucinations
Global instability of priors (GIP) (volatile priors)	Clinical high risk (CHR), early psychosis [49], schizophrenia [50, 51]	Speech perception / semantics: unstable inference, difficulties updating prediction weights, increased reliance on atypical priors

level of predictive dysfunction and the nature of linguistic symptoms to be clearly discerned.

Table 1 highlights that the individual mechanisms of prediction error response manifested at the linguistic level are not dispersed across the literature, but rather form a coherent continuum. They span from sensory motor disturbances characteristic of the early stages of psychotic process development, through semantic disturbances emerging primarily in the course of thought disorganization, to pragmatic and source monitoring deficits observed in full-blown psychosis. The synthetic presentation of these data in Table 1 reveals systematic relationships between the level of predictive processing disturbance and its linguistic manifestation.

The mechanisms of prediction-error responses identified at the linguistic level can be mapped onto the two-dimensional matrix (Fig. 1) to illustrate the

hierarchical organization (to be completed). The evidence from the literature available indicates how the predictive mechanisms at various linguistic levels are disrupted based on the clinical progression of psychotic states. On the Y-axis, which represents the complexity of prediction and the hierarchical organization of the language system, it is seen that as this level advances (from sensory processing to global priors), the vulnerability to psychotic disturbances also advances. At each linguistic level, the predictive mechanisms are increasingly impaired (from subtle to complete dysfunction of efference copy and pragmatics, agency, and global priors in the later stages of psychosis).

The literature available clearly indicates the cascading effect of disruptions in predictive processing mechanisms during the course of psychosis, which affects the language functions. The early sensory and semantic impairments in the course of psychosis can cause disturbances at the

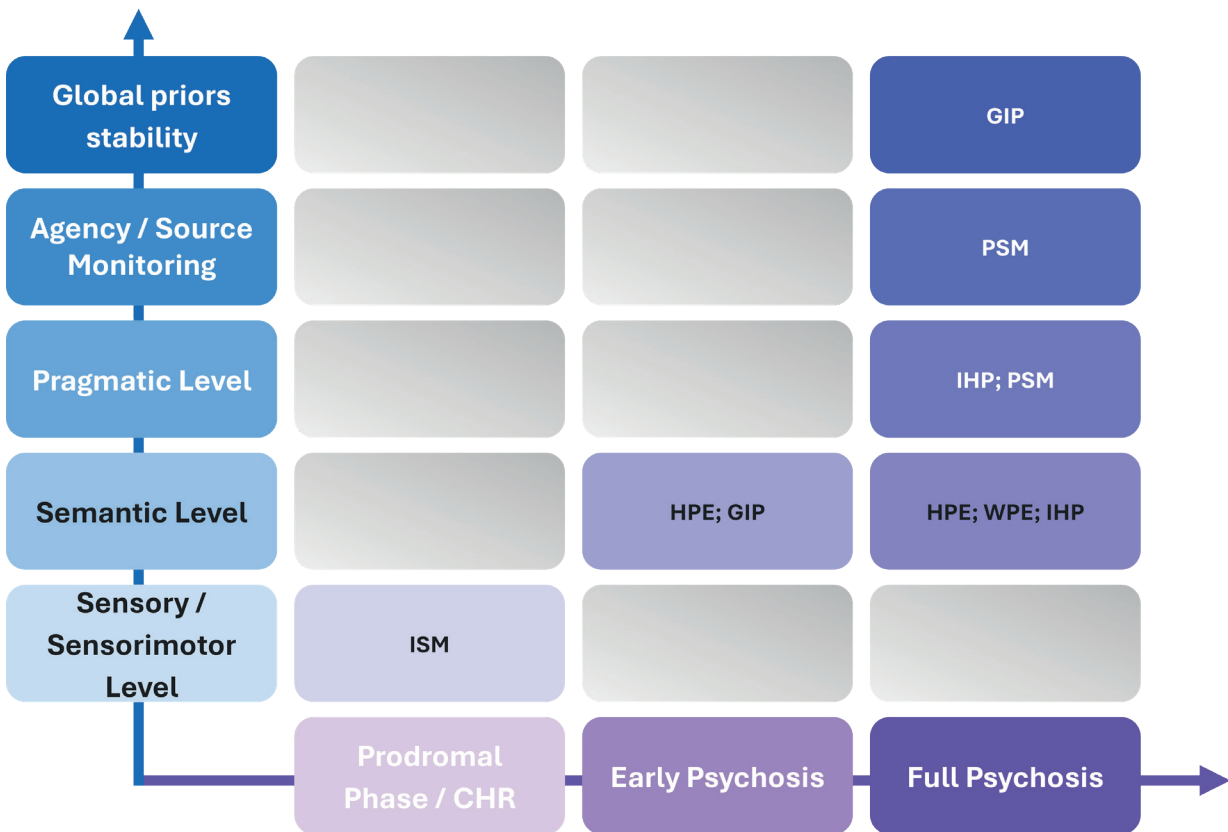


Figure 2. Matrix of Language-Related Predictive-Processing Disturbances in Psychosis

higher levels of linguistic prediction, resulting in pragmatic impairments, speech source monitoring errors, and eventually global instability of predictive models.

Conclusion

The conducted scoping review confirms the thesis that language disturbances described within the behavioural symptomatology of mental disorders constitute diverse manifestations of predictive processing dysfunction. It also highlights the potential for differentiating types of responses to prediction error coding across successive levels of the linguistic hierarchy. In doing so, it rejects the notion of schizophasia as a homogeneous functional deficit. Despite the relatively small number of original studies referring to neurolinguistic analyses in identifying patterns of predictive coding functioning, these studies make it possible to describe language as a system grounded in multilevel semantic, pragmatic, and sensorimotor predictions. The review demonstrates a particular sensitivity of linguistic behaviours to revealing abnormal weighting of prediction errors, disturbances in prediction precision, and instability of a priori models.

The studies included in the review made it possible to distinguish at least six relatively independent, although mutually interconnected, mechanisms of responses to predictive processing errors that manifested at the linguistic level: (1) heightened,

inflexible precision of prediction errors; (2) weakened prediction error signalling; (3) impaired sensorimotor prediction of speech; (4) disturbances in the weighting of prediction error precision against the background of hierarchical semantic-pragmatic prediction; (5) disturbances of predictive source monitoring; and (6) global predictive instability. The identified mechanisms of prediction error responses differentiate the profile of clinical symptoms and the accompanying language disturbances. The available studies allow these mechanisms to be distinguished particularly within the psychotic spectrum.

The review demonstrates the potential for treating language disturbances not only as a secondary indicator of formal thought disorder but as a dynamic marker of the functioning of predictive systems. Disturbances in discourse coherence, fluctuations in semantic entropy, and difficulties in suppressing auditory responses during vocalization, together with weakened neurophysiological responses (for example, measured by the N400 index), exhibit potential for measurable identification of predictive coding deficits using analyses of various levels of linguistic organization.

The literature shows consensus regarding the key role of the lexico-semantic system as the most sensitive to predictive disturbances. This is supported by electrophysiological and behavioural data. However,

discrepancies have been noted in the interpretation of linguistic symptoms at this level (mainly loose semantic associations and neologisms), which do not stem from empirical inconsistency but from differing descriptions of the underlying mechanisms. The review organizes these discrepancies by placing them within a single theoretical framework.

Research on the role of language in analysing prediction error responses in mental disorders remains highly heterogeneous both methodologically and conceptually. Studies tend to focus on single levels and functions of language, with a noticeable lack of integrative analyses. Particularly underrepresented is the neurological–speech therapy (neurolingopedic) perspective, despite its tools being crucial for the development of fundamental predictive model analyses at the linguistic level in neuropsychiatry [52].

The reviewed evidence suggests that the disruptions in the predictive processing systems occur in a hierarchical and cascading fashion, impacting successively higher levels of linguistic abstraction. Taken together, these findings suggest that the psychosis-related prediction error dysfunctions are not simply isolated deficits but system-level problems that lead to global instability of linguistic and cognitive models.

The collected materials suggest that a key component of predictive processing—though mostly treated implicitly—is cognitive inhibition [37,40,43]. This opens the perspective of treating language disturbances in psychiatry as consequences of abnormal regulation of predictive inhibition, both in the form of insufficient inhibitory effectiveness and excessive suppression of error signals [24].

Despite the theoretical coherence of assumptions regarding the role of predictive inhibition in shaping language disturbances, empirical studies confirm these assumptions only fragmentarily and indirectly. There is a lack of unambiguous longitudinal and multilayered research that would enable the specification of the relationship between cognitive inhibition mechanisms and predictive disturbances. Particularly underdeveloped is the elaboration of research paradigms that would allow simultaneous assessment of semantic, sensorimotor, and pragmatic inhibition in the context of the dynamics of predictive coding disorder symptoms.

The application of the predictive coding framework in the present review made it possible to characterize the phenomenon from a functional model perspective. The review does not imply grounds for adopting strong assumptions concerning the literal implementation of Bayesian algorithms in clinical practice.

The review of studies demonstrates the potential of treating neurolinguistic analysis as fundamental

for describing the dynamics of predictive processing in psychiatry. Linguistic behavior is recognized as an active component of pathology and as a target for future translational interventions.

Conflict of interest

The authors have declared no conflict of interest.

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