

## PROMPT-DIALOG IN COGNITIVE SYSTEM «SUBJECT OF KNOWLEDGE – AI»: STRUCTURE, FORM, PATTERN

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*This article presents a comprehensive analysis of the prompt-dialog phenomenon within the cognitive system «Subject of Knowledge – Artificial Intelligence». It argues that the interaction between a human and contemporary intelligent systems (e.g., ChatGPT, DeepSeek) gives rise to fundamentally new mental practices, which represent an externalization of inner speech and a qualitative transformation of thinking itself. The study positions AI not merely as an instrumental tool, but as an active cognitive partner and a unique psychological mirror that reflects, structures, and co-develops the human thought process.*

*The research is grounded in L. Vygotsky's cultural-historical psychology, particularly his concepts of «psychological tools» and the «Inter-Intra» dynamics of higher mental functions formation. The genesis of prompt-dialog is traced from its precursors – inner dialogue and written self-reflection – to its current form as a cognitive interaction with AI. Methodologically, the phenomenon is described through a categorical triad of «structure – form – patterns», which allows for a systematic characterization of this new type of thinking. This framework effectively captures the dynamics of hybrid intelligence formation.*

*The article provides an empirical illustration via a detailed prompt-dialog between a subject and AI, aimed at acquiring the cognitive skill of performing payments through a terminal. This terminal payment case study demonstrates how the cycle of inner speech → prompt (externalization) → AI processing → promptback (interiorization) facilitates the development of self-reflective abilities, algorithmic thinking, and metacognitive control. It is concluded that prompt-dialog fosters the emergence of a hybrid form of thinking, opening new horizons for intellectual partnership with AI. This partnership has profound anthropological significance, transforming educational paradigms and professional practices by establishing prompt-dialog as a new epistemological foundation for 21st-century cognition, enhancing both cognitive flexibility and professional competence.*

**Key words:** prompt-dialog, artificial intelligence, cognitive interaction, neurodidactics, frame-exchange, meaning construction, metacognition, cognitive plasticity, anthropotechnical system, educational transformation.

### **Іванова Лариса, Іванов Сергій. Промпт-діалог у когнітивній системі «суб'єкт пізнання – ШІ»: структура, форма, модель**

*Стаття представляє комплексний аналіз феномену промпт-діалогу в межах когнітивної системи «Суб'єкт Знання – Штучний Інтелект». Стверджується, що взаємодія між людиною та сучасними інтелектуальними системами (наприклад, ChatGPT, DeepSeek, Gemini) породжує фундаментально нові ментальні практики, які є екстерналізацією внутрішнього мовлення та якісною трансформацією самого мислення. Дослідження позиціонує ШІ не просто як інструментальне знаряддя, а як активного когнітивного партнера та унікальне психологічне дзеркало, що відображає, структурує та спільно розвиває людський розумовий процес.*

*Дослідження ґрунтується на культурно-історичній психології Л. Виготського, зокрема на його концепціях «психологічних знарядь» та динаміки «Інтер-Інтра» у формуванні вищих психічних функцій. Генезис промпт-діалогу простежується від його попередників – внутрішнього діалогу та письмової саморефлексії – до його поточної форми як когнітивної взаємодії зі ШІ. Методологічно феномен описується за допомогою категоріальної тріади «структура – форма – патерни», яка дозволяє систематично охарактеризувати цей новий тип мислення. Ця структура ефективно фіксує динаміку формування гібридного інтелекту.*

*Стаття пропонує емпіричну ілюстрацію через детальний промпт-діалог між суб'єктом і ШІ-сервісом, спрямований на набуття когнітивної навички здійснення платежів через термінал. Цей приклад оплати через термінал демонструє, як цикл внутрішнє мовлення → промпт (екстерналізація) → обробка ШІ → промптбек (інтеріоризація) сприяє розвитку здібностей до саморефлексії, алгоритмічного мислення та метакогнітивного контролю. Робиться висновок, що промпт-діалог сприяє виникненню гібридної форми мислення, відкриваючи нові горизонти для інтелектуального партнерства зі ШІ. Це партнерство має глибоке антропологічне значення, трансформуючи освітні парадигми та професійні практики шляхом утвердження промпт-діалогу як нової епістемологічної основи для пізнання XXI століття, підвищуючи як когнітивну гнучкість, так і професійну компетентність.*

**Ключові слова:** підказка-діалог, штучний інтелект, когнітивна взаємодія, нейродидактика, обмін фреймами, конструювання значень, метапізнання, когнітивна пластичність, антропотехнічна система, освітня трансформація.

**Problem statement.** Humanity is currently experiencing a new anthropological turn, driven by the rapid integration of artificial intelligence (AI) technologies into all spheres of society, particularly in education. While in the early stages AI services functioned primarily as «smart search engines», recommendation systems, and adaptive tests, today they constitute advanced intelligent systems, some of which feature reflexive feedback and implement new mental algorithms capable of modeling the cognitive operations of the knowledge subject, effectively becoming partners in cognitive activity. The widespread adoption of such systems in educational practice inevitably raises questions not only about the pedagogical advantages and risks of these new tools, but also about a deeper – anthropological – dimension: how the use of AI transforms the very process of human thought.

UNESCO documents (2021–2025) and other international organizations emphasize the role of AI in expanding learning opportunities, personalizing educational processes, and developing creative competencies, viewing AI services as tools that enhance the capabilities of both teachers and learners [UNESCO]. However, it should be noted that these documents analyze the state of technology at the time of their preparation. Meanwhile, the landscape of AI services is evolving at such a rapid pace that the conceptual framework for interpreting them requires continuous updating [10]. This necessitates not only pedagogical, but also psychological foundations that can describe the transformation of human thinking in interaction with intelligent AI systems.

Particular importance is attached here to L. Vygotsky's cultural-historical framework. According to his approach, the development of higher psychological functions is associated with the use of «psychological tools», which reorganize not only the content but also the very structure of thinking. Contemporary AI services can be regarded as a new type of such tools [2; 4]. The widespread adoption of these systems in educational practice inevitably raises questions not only about the pedagogical advantages and risks of new instruments, but also about a deeper – anthropological – dimension: how the use of AI transforms the process of human thought itself. Their application extends cognitive activity beyond the confines of single-subject inner speech, converting it into an external, interactive, and reflexive form of intellectual partnership [8].

A hypothesis emerges that the intellectual partnership between a subject of cognition and AI in educational and professional contexts gives rise to a new, hybrid form of thinking – prompt-dialog. Such prompt-dialog facilitates the development of novel cognitive and metacognitive practices. In essence, prompt-dialog-based AI services become new «psychological tools» (in the terminology of Vygotsky), possessing properties that engender new forms of thinking – its structure, form, and patterns – within the cognitive process [15].

Consequently, the emergence of prompt-dialog as a new form of cognitive interaction between humans and AI will necessitate a re-examination of conventional understandings of the subject of cognition and its new «psychological tool» – AI services.

**The aim of the article** is to conceptualize prompt-dialog as a new form of cognitive interaction within the «Subject of Knowledge – AI» system, revealing its role in transforming the structure, form, and patterns of human thinking and in shaping new psychological tools for education in the age of artificial intelligence.

**Results.** The phenomenon of internal speech and ways of thinking. Humanity is currently undergoing a new anthropological turn, driven by the rapid integration of artificial intelligence technologies into all spheres of life, primarily education. Intelligent systems, beginning with the functions of intelligent search engines like Bing AI, Google Scholar, or Wolfram Alpha, have evolved into adaptive platforms and services with reflexive feedback, capable of interacting with the user in a mode of intellectual dialog.

The mass adoption of such services necessitates not only an assessment of the advantages and risks of these new approaches but also a deeper understanding of their anthropological significance: how the very forms of human thinking are being transformed through interaction with AI [5].

It is in this context that Vygotsky's classical concept of inner speech regains its relevance. The thinker himself does not provide a definitive definition of the phenomenon, referring to it at times as a «specific speech function» and at other times as a «support and tool for thinking» [15]. Emphasizing the dialectical nature of this phenomenon, we propose the following definition: inner speech is the dialectical unity of speech form and its function as a psychological tool, capable of transforming cognitive processes.

Inner speech can be regarded as a particular form of verbal activity, distinguished by its condensed nature, incomplete grammatical structure, and self-directed orientation. Its significance is revealed not only through these formal features: it simultaneously serves as an instrument for thinking, planning, self-regulation, and reflection [2]. Moreover, form and function are inseparably linked: changes in tasks and goals transform the form of inner speech, while its function is realized only through these formal structures. Thus, inner speech emerges as a living, dynamic process in which form and function mutually support and develop one another. In the context of the emergence of intelligent systems with human – AI feedback, this understanding gains particular importance, as it allows for a more comprehensive analysis of transformations in contemporary cognitive practices [8].

The historical dynamics of interest in inner speech demonstrate its evolving significance: from the early studies by L. Vygotsky and O. Luria in the 1930s, through a decline in attention in the mid-20th century, to a revival in cognitive psychology during the 1960s–1980s (e.g., studies of private speech, often intermittent, in children and adults), and a new wave of research in the 21st century enabled by neuroscience and digital technologies [8; 11]. At each stage, the novelty of perspectives manifested differently: inner speech was viewed as a regulator of behavior, a cognitive tool, a neuropsychological phenomenon, and an element of metacognition.

Ontological Content of Types of Thinking in prompt-dialog: structure, form, and patterns. The emergence

and widespread adoption of new «psychological tools» not only enhances existing types of thinking but also generates or qualitatively restructures them. This process is analogous to the formation of higher psychological functions (HPFs) in children, which, according to Vygotsky, follows the «Inter-Intra» principle: a function first develops collaboratively at the social level («inter-») and is then internalized by the individual, becoming part of their personal cognitive repertoire («intra-») [3; 15].

Prompt-dialog, as an implementation of this principle in the «subject of cognition – AI» dyad, represents a new form of thinking that can be described through the categorical triad of structure, form, and patterns. We employ this triad not as a psychological reduction, but as a methodological framework that allows the identification of systemic characteristics of this type of thinking [2; 4]. In this form of thinking, a key aspect is the ability to pose questions (prompt) and to respond meaningfully to AI answers (promptack), effectively transforming artificial intelligence into a fully-fledged «psychological tool» for cognitive development. The mastery of this new «psychological tool» by an adult in the course of prompt-dialog mirrors the same principle: a cognitive function (e.g., critical analysis or idea generation) is first developed in dialog with AI as the «other», and is then internalized and incorporated into the individual's cognitive repertoire [12].

Experimental studies indicate that different types of thinking are activated in distinct regions of the human brain, highlighting their functional specialization and cognitive differentiation [6;11]. A systemic approach allows prompt-dialog to be viewed as an implementation of the «Inter-Intra HPF» principle. Within prompt-dialog, types of thinking represented by the triad «structure – form – patterns» undergo transformation. Each type possesses unique characteristics and functional capacities.

Structure reflects the internal organization of cognitive activity: how information elements are interconnected, and what hierarchies, sequences, or networks exist. In logical thinking, structure is strictly sequential and hierarchical, whereas in creative thinking, connections between ideas tend to be networked and nonlinear.

Form characterizes the external expression of thoughts, their realization through various symbolic systems: verbal and written constructions, symbols, graphical schemes, and images. Form simultaneously enables communication and self-regulation of the thought process.

Patterns represent recurring strategies of information processing and typical pathways of cognitive operations. They reflect habitual methods of analysis, reasoning, or idea generation. In traditional forms of thinking, these may include deduction, induction, categorization, analogy, experimentation, and self-monitoring. Based on this approach, a table can be constructed comparing the types of «psychological tools» prior to the emergence of AI services with the inherent components of the corresponding types of thinking (Table 1).

As shown in Table 1, each new «psychological tool» not only expanded the repertoire of expressive means but also qualitatively transformed the very process of thinking as follows from external to internal. Speech and writing externalized thought, making it an object of analysis. AI, while remaining an external tool, elevates thought to a new level for collaborative processing and refinement and then from linearity to networks. The linear structure of writing was replaced by the hierarchy of printed text, which in the digital age unfolded into nonlinear networked forms. AI adds a fundamentally new dimension – dialogical interactivity hierarchy of printed text [2; 4; 13].

The further evolution of «psychological tools» proceeded from individual forms of thinking to multi-subject forms, from monologue to dialog. Table 2 illustrates the evolution of AI services that generate new combinations of thinking types in the course of prompt-dialog.

The emergence of modern AI services based on large language models (LLMs) (e.g., ChatGPT, DeepSeek, etc.) has enabled the conduct of full-fledged prompt-dialogs within the «subject of cognition – AI» system, leading to new transformations of the fundamental components of thinking (Table 3):

The table illustrates how prompt-dialog transforms the subject's thought into a collaborative action with AI, forming a new type of hybrid thinking through a recurring

Table 1

**Components of the types of thinking for «psychological tools»**

Psychological tools	Structure (Frame of thinking)	Forms (Modes of Unfolding)	Patterns (Stable Schemes)
Book	Linear	Story, discourse, treatise	Introduction reasoning conclusion; quote-comment
Television	Linear, figurative fragmented	Report, story, show	Frame-comment; «hero-reaction»; dramatic trio
Internet	Vectorial, hypertext	Site, search, forum	Link-transition; FAQ; discussion branch
Social media	Network, streaming	Message feed, comments, flashmobs	Laik-repost; meme-variations; trolling-protection

Table 2

**Evolution of AI Service Types and the Extent of prompt-dialog Implementation**

Generation of AI	Key Properties	Cognitive Functions	Prompt-dialog Capability
Early expert systems	Rules, knowledge base	Answer to Specific Questions	No
Machine learning (ML)	Classification, forecast	Support for decision-making	Limited
Neural network	Recognition of images, texts	Content generation, associative responses	Partially
Modern LLM / ChatGPT	dialog, reflection, interactive	Support of iterative thinking, co-construction of knowledge	Fully Implemented

Prompt-dialog: Structure, Form, and Patterns Across Cycle Stages

Stage prompt-dialog	Structure	Form	Patterns
Inner speech	Condensed predicative	Subject's thought	Associations, plans, hypotheses
Externalization (prompt)	Linear / textual	Question, command	Thought Unfolding, Efinement
Processing prompt	Dialog, network transformation	Response, structuring, hypothesis generation	Processing information, suggesting options, correcting errors
Interiorization (promptback)	Conscious	Internal analysis, reflexivity	New patterns of action, skill consolidation, hybrid thinking

cycle: inner speech → prompt → AI algorithms → prompt-back [8; 16].

Thus, the hypothesis is confirmed: historically, each new psychological tool gave rise to new higher mental functions and shaped a distinct type of thinking – with its own structure, form, and patterns [15]. In this context, AI services emerge as a revolutionary psychological tool, fostering prompt-dialogical thinking as the epistemological foundation of 21st-century education, with profound anthropological significance [5].

Demonstration of types of thinking in prompt-dialog. Demonstration of types of thinking in prompt-dialog. To illustrate, consider a concrete example of prompt-dialog in which the subject of knowledge acquires the skill of making payments via a smartphone through a terminal. In this process, internal cognitive operations (such as analyzing instructions and matching actions with expected outcomes) are externalized into textual commands or questions addressed to the AI service (prompts). The AI's responses are then interiorized, processed, and become the basis for the next step, creating an iterative learning cycle (prompt-back). This response simultaneously engages logical, critical, creative, and meta-prompt thinking, and the structure–form–patterns triad allows a detailed description of how the subject's thought is transformed through interaction with AI [8; 16].

**Stage 1:** Cognitive training and planning (Reflexive-pedagogical pattern)

*subject (C):* Formulates the request to the AI, verbalizing its purpose. It is an act of externalization – bringing out the internal problem in the AI-service:

*Prompt:* I have never paid for purchases through the terminal, only through the cashier. Explain how it works and what I need to do in steps.

*AI-service:* Acts as a «psychic tool». Structures information, breaks down complex skills into elementary actions

*Promptback AI:* Of course! It's simple. The process consists of 4 basic steps:

1. Preparation: Pick up the goods, find the self-service terminal
2. Scan: Scan the QR code on the terminal to start the session. Scan the barcodes of each item.
3. Payment: Check the list on your screen and select the payment method (card/phone).
4. Completion: Take the check.

What step do you have questions?

**Stage 2:** Heuristic execution and monitoring (Heuristic and algorithmic pattern).

*Subject (C):* Being in front of the terminal, faces the first problem. Internal dialog («What to do?») passes into external – dialog with AI.

*Prompt:* I found a terminal. There are some icons on the screen. Which one should I choose to start?

*AI-service:* Acts as a tool of orientation. Does not give a ready answer, but directs attention to the key signs, forming an algorithm for action.

*Promptback:* Do not look for the «start» button: please note – is there a large QR code on the main screen? This is what you need to scan with your phone in order to attach the cart to your account in the store app. This is the first step.

*Subject (C):* Performs the action, monitors the result and gets a new problem.

*Prompt:* I scanned the QR code, my cart opened on my phone. I scanned the first product, it was added. But how do I check that all products are added? I don't see the total".

*AI-service:* Corrects action, anticipates next step. Forms «control-check» pattern.

*Promptback:* The total usually appears on the terminal screen after you click «Finish scan» or «Go to payment». It is often green or yellow. Look at the panel on the right.

**Stage 3:** Error correction and debugging (Algorithmic and emotionally-supporting patterns)

*Subject (C):* Encounters a mistake. Cognitive dissonance and negative emotion (confusion) arise. Problem recruitment is the key to solving it.

*Prompt:* «I scanned everything, clicked «pay», but the terminal says «Bank communication error». What to do? I didn't break anything?»

*AI-service:* It acts as a tool for emotional regulation and debugging. Normalizes errors, removes anxiety, provides a clear algorithm for actions.

*Promptback:* This is a common mistake, don't worry. You haven't broken anything. The algorithm is:

1. Click «Try again».
2. If it does not work, click «Cancel» or «Return».
3. The payment session will start again, but the goods will remain in the cart.
4. Try to attach the card a little slower or choose another method of payment (for example, by phone if you paid with a card). This is a system error, not your own.

**Stage 4:** Binding and internalization (Reflexive pattern)

*Subject (C):* Upon successful execution of the action initiates a meta-cognition reflection with AI to secure the successful pattern.

*Prompt:* «Great, it worked! I took the check. So, let's repeat so that I remember: what was the main sequence of steps?»

AI-service: Acts as a structuring tool of memory. Helps to package the experience into a clear mental scheme.

Promptback : Right! Here is the final algorithm:

1. Find the QR code of the terminal -> scan it with your phone.

2. Scan barcodes of all products.

3. Press «To pay» -> check the list.

4. Attach card/phone -> wait for the inscription "Paid".

5. Take a check.

Next time you do this automatically".

Consider how AI-service as a «psychic tool» implemented the triad of thinking:

Structure: AI provided the action skeleton – a clear algorithm of 4–5 steps that replaced the chaotic representation of the subject.

Form: AI gave verbal and visual form to thought acts: "find the QR code", "press the green button", "check the list". The thought has found specific orientations.

Pattern: Repetition of steps, debugging errors according to the proposed algorithm and final reflexivity formed a stable cognitive pattern – a mental program that the subject will launch the next time already without the help of AI (full internalization will take place).

Thus, this meta-dialogue is an example of how a higher mental function (conscious payment skill) is initially formed as an action shared between a person and a tool (AI), and is then «appropriated» by the subject of cognition itself, becoming its internal possession.

**Conclusion.** The conducted analysis demonstrates that the evolution of educational paradigms cannot be adequately described without considering the dynamics of categorical structures. From the world of givenness characteristic of Antiquity and the Middle Ages, through the emergence of scientific rationality in the Early Modern period, to the complex uncertainty of the digital and post-VUCA era, education has continuously expanded the spectrum of its defining categories. A decisive role in this process is played by the gradual inclusion of the *image of the future* as a constitutive factor of educational discourse.

At the contemporary stage, the emergence of AI services marks a turning point comparable to the invention of writing or printing. These tools are not merely technical means but new forms of psychological instruments mediating thought itself [2; 4; 15]. Their evolution – from primitive search engines and reference databases to adaptive, dialogical, and generative systems – has enabled the development of prompt-dialog [10].

Prompt-dialog should be understood as a new form of cognitive interaction between humans and AI, in which both parties contribute to the generation, structuring, and interpretation of knowledge. In this sense, prompt-dialog becomes not only a methodological innovation but also an epistemological foundation for 21st-century education. Its significance carries an anthropological dimension, as it transforms the very ways humans think, learn, and engage in future-oriented activities [5; 14].

Education in the AI era will increasingly rely on the ability to construct and sustain productive prompt-dialogs. This necessitates a rethinking of curricula, the role of educators, and the educational environment [7; 9]. It also calls for the creation of new ethical and cultural frameworks that ensure a balance between technological enhancement of cognitive capacities and human responsibility [1].

In conclusion, the transition from monological to prompt-dialogical forms of thought represents one of the deepest transformations in the history of education. It provides an opportunity to overcome the limitations of traditional paradigms and to develop an educational discourse that is open, adaptive, and future-oriented. By embracing prompt-dialog, education can become a space where human and artificial intelligences collaboratively generate knowledge, anticipate challenges, and jointly design pathways into an uncertain yet promising future.

Future research will focus on developing the theoretical and methodological foundations of frame-exchange technology as a neurodidactic mechanism underlying the prompt-dialog process. This direction aims to empirically validate the cognitive, emotional, and neurophysiological effects of human–AI frame exchange in learning environments.

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