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Theory of Mind: A Brief Review from Historical Roots to Contemporary Developments

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ABSTRACT

The concept of mind has been addressed across various disciplines, including philosophy, psychology, and neuroscience. Due to its interdisciplinary nature, the literature can be complex for newcomers. Although the concept of "mind" is approached differently across these fields, they all seek to answer the same fundamental question: What is a mind, and how can we access the mind of another? This article examines the philosophical foundations of the mind's existence and explores contributions from psychology and neuroscience on how we comprehend others' mental states. The review aims not only to categorize and summarize previous literature on Theory of Mind (ToM) but also to highlight recent debates and research conducted in Türkiye. In this context, the paper discusses the philosophical roots, theoretical frameworks, assessment methods, the relationship between ToM and language, neural correlates, developmental processes, and associations with psychopathology. In conclusion, this review offers a multidisciplinary perspective on current discussions, underscoring the importance of integrating global theoretical models with local research findings.

Keywords: *Theory of mind, Theories of theory of mind, Theory of mind task*

Zihin Kuramı: Tarihten Günümüz Gelişmelerine Kısa Bir Derleme

ÖZET

Zihin kavramı; felsefe, psikoloji ve nörobilim gibi pek çok disiplinin ortak inceleme alanıdır. Bu disiplinlerarası doğası nedeniyle, ilgili literatür alana yeni giren araştırmacılar için karmaşık olabilmektedir. Farklı disiplinler zihni farklı biçimlerde ele alsa da, hepsi özünde aynı temel soruya yanıt arar: Zihin nedir ve bir başkasının zihnine nasıl erişebiliriz? Bu makalede, zihnin varlığına dair sorular felsefi temellerden başlanarak ele alınmış; bir başkasının zihnini anlama süreci

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ise psikoloji ve nörobilim disiplinlerinin katkılarıyla incelenmiştir. Çalışmanın amacı, Zihin Kuramı literatürünü bütüncül bir bakış açısıyla sunmaktır. Bu kapsamda; zihnin felsefi kökenleri, Zihin Kuramı'nın tanımları ve teorik çerçeveleri, değerlendirme yöntemleri, nöral temelleri, gelişimsel süreçleri, psikopatolojiyle bağlantıları ve Türkiye'de yürütülen güncel araştırmalar detaylandırılmıştır. Sonuç olarak, bu derleme, geçmiş çalışmaları kategorize etmenin ötesinde, güncel tartışmaları ve yerel literatürü bir araya getirerek alana ilgi duyan özellikle yeni başlayan araştırmacılara kapsamlı bir kaynak sunmayı hedeflemektedir.

Anahtar Kelimeler: *Zihin kuramı, Zihin kuramı teorileri, Zihin kuramı görevleri*

1. INTRODUCTION

The concept of mind is present in literature spanning from ancient philosophical debates to modern scientific disciplines. While philosophical debates discuss arguments regarding the existence and origin of the mind, modern scientific disciplines examine mental processes and the mechanisms by which these processes operate. The ability to understand and attribute the mental states of others is a capacity formally known as Theory of Mind (ToM; Premack & Woodruff, 1978), which stands out as a fundamental component of social cognition.

ToM has been examined across numerous disciplines, resulting in a fragmented body of literature. This review addresses this gap by presenting a comprehensive synthesis of ToM research across multiple disciplines. This article aims to facilitate the reader's understanding of ToM by providing a categorized review of the relevant literature. First, the historical and theoretical background of ToM is discussed, followed by an examination of commonly used measurement tasks and their associated neural correlates. The review also extends to the developmental aspect of ToM, specifically its relationship with language, and evaluates its significance within the context of psychopathology. Finally, the topic is concluded by examining current debates and studies conducted in Türkiye. The article aims to provide the reader with a comprehensive framework by categorizing and classifying ToM studies.

2. PHILOSOPHICAL FOUNDATIONS OF MIND

The human mind has always been inquisitive, asking questions about what the human mind is, where it is, and why it exists—a curiosity that has led philosophers of antiquity to modern scientists. Is the mind a non-material entity? Or is the brain all that the mind is? One of the core issues in psychology that is being debated today is these two concerns. Although the terms "body" and "brain" can be used interchangeably, literature usually refers to this issue as the Mind-Body Problem.

The mind-body dilemma is the problem in determining the nature of the link between the mind and the body or brain, specifically whether mental activities are a subset of physical events (Revonsuo, 2009). The problem called the mind-body dilemma was first proposed by the French philosopher René Descartes in his Meditations on Philosophy, dated 1641

(Westphal, 2016). Keith Campbell (1970) proposed the following four formulations of this dilemma: the mind is a non-physical entity, and the body is a physical entity; the mind and body can interact, yet the non-physical entity and the physical entity cannot interact. The first part suggests that the mind is not composed of physical matter. It implies that mental processes, thoughts, and consciousness are not reducible to or explainable solely in terms of physical processes. The second part states that the body or brain is a physical entity, composed of material substance, governed by the laws of physics. The third part is an apparent interaction between the mental and physical aspects. This interaction is observed in our everyday experiences, where mental events (like thoughts and feelings) seem to influence physical actions (like behavior). The last part is a paradoxical aspect of the formulation. It suggests that the non-physical nature of the mind and the physical nature of the body or brain should, by conventional understanding, make the interaction impossible. While these four arguments cannot be easily dismissed, it is also not possible to consider these four arguments as true at the same time, as this would create contradictions. These arguments are discussed in terms of two fundamental approaches: Monism and Dualism.

Essentially, monism argues that the mind and the brain are the same (Schaffer, 2018), whereas dualism holds that they are distinct entities (Robinson, 2023). There are several perspectives on monism, including idealism, physicalism, and neutral monism (Joad, 1957). Idealism asserts that our thoughts are what really exist; it contends that the mind is superior, particularly the brain, and that the mental processes we experience on a personal level cannot be comprehended by physical processes (Pols, 1993). Despite this, physicalism, often known as materialism, holds that the mind is nothing more than matter and that all mental processes have a physical counterpart (Boyd, 1980). Neutral monism contends that because the basic neutral entities are both mental and material in nature, mind and matter are not as distinct as they seem, providing an answer to the mind-body puzzle (Banks, 2021). Conversely, dualism asserts that the physical and mental domains are distinct entities that cannot be reduced to one another (Pietroski, 1994). More specifically, Cartesian dualism, introduced by René Descartes (1596–1650), argues that the mind and body are two separate entities that can interact with each other (Almog, 2002). Claiming that the mind and brain are two separate entities raises the question of how they interact. An injury to the skin causes pain (body to mind), a decision causes the arm to go up (mind to body), so the mind seems to interact with the body (Chalmers, 2022). Then, where do the mind and body interact? René Descartes sought an answer to this question. He proposed that although the mind and body were distinct entities, they communicated with one another via the pineal gland, a small organ located in the brain (Clarke, 2005).

One of the monist arguments comes from developing neuroimaging methods. Task-fMRI has shown that every mental experience has a neural correlate in specific regions of the brain. This mental experience can be matched to the brain region. However, while damage to these regions does not always result in mental loss, in some cases, deficits overlapping with loss are currently being debated based on these findings (Masi, 2023; Glannon, 2020). Similarly, contemporary network neuroscience challenges strict reductionist explanations

by suggesting that cognitive functions come from interactions among distributed, dynamic neural systems rather than just local areas (Mišić & Sporns, 2016; Uddin, 2021). These findings support non-reductionist models. In these models, mental phenomena arise from neurobiological substructures but cannot be fully explained by them. However, modern philosophy of mind is increasingly open to intermediate views. Functionalism and emergentism try to resolve contradictions by providing non-reductionist, scientifically grounded explanations of the mind. On the other hand, emergentism claims that mental properties arise from interactions of complex physical systems, like neurons, but cannot be reduced to these parts. In other words, mental properties are new, emergent properties (Scheffel, 2020). This view often holds that mental states are physically independent, though not all the properties of a physical entity can be disrupted. Functionalism is defined by its functional or organizational role in providing a physical system. This means the focus is not on what the biological components are, but on how they are arranged, what they function for, and their relationships with inputs and outputs (Butterfield & Gomes, 2020).

Consequently, the "Mind-Body Problem," while addressing the ontological status of the mind (what it is), directly leads to the epistemological "Problem of Other Minds" (how we know that others exist). If the mind is a private, internal experience, how can we access another person's thoughts? This was the conceptual precursor to the empirical study of ToM. Understanding how we perceive the minds, thoughts, and intentions of others has since become a major area of research integrating insights from psychology, neuroscience, and cognitive science.

3. CONCEPTUAL DEFINITION OF THE THEORY OF MIND

The conceptual definition of Theory of Mind (ToM) was first made by Premack and Woodruff in 1978. ToM is defined as the capacity to deduce and comprehend the mental states of others to forecast their behavior. Our knowledge and beliefs influence or cause a great deal of our behavior (Schick et al., 2007). ToM here refers to the capacity to infer all the mental states (beliefs, wants, intentions, emotions, etc.) that give rise to these behaviors. ToM serves as the foundation for all conscious and unconscious cognition about human behavior; it also guides subsequent processing of data that has been classified, such as inference, prediction, and explanation (Malle, 2002). Put simply, being able to think about one's own and other people's thoughts is a prerequisite for possessing a ToM (Baron-Cohen, 2001). In their seminal study, Premack and Woodruff (1978) presented chimpanzees with video recordings of specific problems, followed by images depicting potential solutions. The chimpanzees consistently selected images representing appropriate resolutions for the observed problems. Based on these findings, Premack and Woodruff (1978), and later Brüne and Brüne-Cohrs (2006), proposed that chimpanzees might possess the ability to attribute mental states to conspecifics.

Research on ToM increased after Premack and Woodruff's work, and several scholars provided different interpretations for the concept of ToM. Johnson and Wellman (1980) defined ToM as a child's capacity to distinguish between mental and physical states and to

employ terms associated with mental states properly and suitably. Later, Wellman and Estes (1986) extended the concept to act by concluding mental states, including emotions, requests, and dreams. Furthermore, Baron-Cohen (1995) refined the concept by arguing that ToM consists of four basic modules. While some of these elements are shared with other species, others are unique to humans. The first component, the Intentionality Detector, interprets the volition of a living being based on its movement. The second, the Eye-Direction Detector, allows an individual to track another's gaze. Both modules typically develop by the ninth month of infancy. The third component, the Shared-Attention Mechanism, emerges around the 18th month and establishes a triadic relationship between the self, another person, and an object. Finally, around age five, the Theory of Mind Mechanism develops, enabling the understanding that one's own mental states can differ from those of others (Baron-Cohen, 1995). On the other hand, according to Sabbagh (2004), there are two fundamental parts of ToM. The first of them is the idea of mental state decoding, which involves interpreting the mental states of others based on visible cues like their body language or voice tone. The other element is the idea of mental state reasoning, which refers to making judgments about other people's mental states based on reasoning as opposed to visible cues (Sabbagh, 2004). Similarly, Shamay-Tsoory and collegues (2005) introduced a distinction between cognitive ToM (mental representations of what others know) and affective ToM (mental representations of others' feelings).

ToM is linked to concepts such as mentalizing and empathy. Firstly, mentalizing is a concept that includes the ability to perceive and understand situations such as thoughts, feelings, beliefs, and needs that exist in the background of the mental states of oneself and others, and the behaviors that are seen as a reflection of these (Bateman & Fonagy, 2010). The concepts of mentalization and ToM can also be used interchangeably (Astington & Dack, 2008). Secondly, there are differences between empathy and ToM, both conceptually and in the field of neural networks. While empathy, which is individuals' sharing another's emotional states, is an affective process, ToM, which is taking another's perspective, is a cognitive process (Stietz et al., 2019). The neural foundations of ToM and empathy appear to be represented in distinct regions of the brain. The anterior insula (AI) and middle anterior cingulate cortex (mACC) are the main regions associated with empathic responding (Fan et al., 2011). On the other hand, ToM is associated with the temporoparietal junction (TPJ), temporal poles (TP), medial prefrontal cortex (mPFC), and posterior cingulate cortex (PCC) (Schurz et al., 2014).

While numerous conceptualizations and models have been proposed regarding the structure and components of ToM, there is no consensus on the concept's scope and underlying mechanisms (Schaafsma et al., 2015; Apperly, 2012). In its broadest definition, it can be understood as the capacity to perceive others as mental beings and to interpret and structure social interactions accordingly (Astington & Baird, 2005). Furthermore, these numerous perspectives on ToM suggest that ToM is not a unidimensional construct but rather a multidimensional capacity encompassing cognitive, affective, and neural components. Given that this multidimensional nature is rooted in various theoretical models of

development, examining the major theories of ToM is essential for a deeper understanding of the concept.

4. THEORIES OF TOM

A multitude of perspectives about the development and operation of ToM skills have come to light with the growth of ToM theories. Three categories—Modularity Theory, Simulation Theory, and Theory of Theory—are used to organize the theories that have been proposed for this purpose.

4.1 Modularity Theory

Modularity theory contends that there are different modular components in the mind's structure. Regarding the concept of modularity, proponents argue that these mechanisms are characterized by domain specificity (tailored to handle only social information) and obligatory firing (automatic, rapid processing of social cues without conscious effort) (Baron-Cohen, 1994). As per the notion of modularity theory, ToM is a product of the brain and guided by the intrinsic neural system, which is tailored for mental state reasoning (Fodor, 1983). In other words, this theory argues that ToM has a modular structure in the brain and that these modules are specific only to tasks related to ToM.

Consistent with modularity theory, specific brain correlates associated with ToM inference have been identified. For example, the posterior cingulate cortex (PCC) and bilateral temporoparietal junction (TPJ) are activated in participants exposed to stories involving individuals' mental processes (Saxe & Powell, 2006). Furthermore, greater activation was observed in the right TPJ compared to the left TPJ when false belief tasks were administered (Döhnel et al., 2012). These findings could be interpreted as the existence of an autonomous system in the brain for ToM. However, for the right TPJ, Mitchell (2008) suggests that the same rTPJ region supports attentional control for social and nonsocial stimuli. More recent network analyses challenge strict modularity, showing that these regions are also recruited for general attentional reorienting (Quesque & Rossetti, 2020). These findings limit the autonomous module assumption predicted by modular theory. Current neuroscience literature suggests that cognitive functions are not carried out through autonomous modules, but rather through larger, dynamic networks, and that specific brain regions contribute to multiple functions. Therefore, although the modular approach strongly defends the innateness thesis, it falls short in addressing the flexibility of cognition and its dependence on environmental stimuli.

4.2 Simulation Theory

According to simulation theory, an individual understands others' internal states by using their own mental processes to simulate that person (Goldman, 2006; Gallese & Goldman, 1998). This simulation is assumed to be facilitated by mirror neurons, which are systems recruited during the perception and execution of identical actions (Dapretto et al., 2006). Mirror neurons play a role in understanding the intentions behind actions performed by

others (Rizzolatti et al., 2009). This network can assist in simulating the mental states of others by directly mapping their intentions, namely, their behavior, to the self (Iacoboni, 2009). For instance, when a person shares something with eyes brimming with tears, the respondent's voice may quiver in response. The main notion of this theory is that individuals may directly access their own psychological experiences and the meanings they assign to them, allowing them to make sense of mental processes (Gordon, 1992). Put differently, while analyzing the mental processes of others, they imagine themselves in their shoes and then read about what they could go through in the relevant circumstance (Harris, 1992). According to Meltzoff (1999), simulation theory indicates that inherent representations are absent. Along with the notion that there are no inherent representations, it is asserted that internalizing mental states can only happen by copying the other person's processes using their own mental states (Flavell, 1999).

It has been suggested that the ability to attribute mental states to others evolved from the mirror neuron system (Rizzolatti & Craighero, 2004). However, attributing to the mental states of others through ToM is not solely based on imitating others. It also depends on our ability to distinguish our own behavior from that of others. For example, Mitchell (2008) found that a ventral subregion of the mPFC increased activity for both self-perception and perceptions of similar individuals, while a dorsal region was significantly activated for perceptions of dissimilar individuals. Thus, simulation theory explains only one component of ToM. It is related to understanding others, particularly affective states, but is not comprehensive enough in situations requiring cognitive inference. In this respect, simulation theory is thought to be more relevant to empathy and affective ToM (Schaafsma et al., 2015).

4.3 Theory-Theory

The theory-theory framework posits that understanding the mind is an act of conceptual construction. People develop a "theory" to explain their own and others' mental states, much like scientists revise theories based on new observations (Gopnik & Wellman, 1992). This constructivist view suggests that preschool children actively construct information from their social environment and develop their understanding as they mature (Hughes & Leekham, 2004; Gopnik, 2003). For example, consider Ahmet giving a friend candy because he knows the friend is sad. This behavior demonstrates that Ahmet uses a "theory" to predict how an action (giving candy) will affect an outcome (happiness). Therefore, ToM is viewed not as an instantaneous capacity, but as a long-term developmental achievement based on cognitive inference (Youmans & Bourgeois, 2010). According to the Theory-Theory framework, experience plays a crucial role in the development of ToM skills (Brüne & Brüne-Cohrs, 2006). Individuals revise, reorganize, and construct their own conceptual theories through experience, enabling them to infer the mental representations of others. Because of this reliance on information processing and inference, Theory-Theory is strongly linked to the cognitive dimensions of ToM (Schaafsma et al., 2015).

In comparison, while modularity theory adopts a nativist and evolutionary perspective, the theory-theory approach embraces a constructivist approach and the ability to make mental inferences; simulation, on the other hand, focuses on the ability to share experiences with other people. Although these three theories offer valuable frameworks for explaining different aspects of ToM, each has its own limitations. Modularity Theory's reliance on autonomous, specialized brain structures contradicts modern neuroscience, which demonstrates that cognitive functions operate through extensive, flexible networks (Schurz et al., 2014). Similarly, while Simulation Theory is successful in explaining empathy and emotional states, it struggles to explain complex cognitive inferences and abstract thought (Abu-Akel & Shamay-Tsoory, 2011). The theory-theory approach emphasizes that ToM begins in childhood and progresses through cognitive inference abilities developed through experience, but it offers a perspective that focuses more on cognitive functions (Heyes, 2014). On the other hand, the Theory Theory approach, by treating ToM solely as an overt cognitive activity, ignores the implicit processes and unconscious activity (Apperly & Butterfill, 2009). Therefore, the multifaceted nature of ToM cannot be fully understood by a single theoretical model. This complexity has necessitated the development of a wide variety of tasks to measure its diverse dimensions.

5. OPERATIONAL DEFINITIONS OF TOM

The studies investigating ToM measure ToM skills in several different ways. ToM encompasses a variety of skills, and these skills may be examined at different levels, which is why it is proposed that the techniques used to measure it vary so greatly (Harrington et al., 2005). The most popular measurement instruments for ToM skills used in the research settings include first-order belief tasks, second-order false belief tasks, linguistic tasks, and reading the mind in the eye tasks (Bach et al., 2000).

First-order false belief refers to the ability to attribute a belief to another person. In other words, it is the skill that expresses the ability to understand that one's own thoughts and others' thoughts may be different from each other (Bach et al., 2000). Stories are often used in tasks that assess first-order false belief comprehension skills. The Sally-Anne story seen in Table 1 is an example of these stories created by Baron-Cohen and colleagues (1985). First-order false belief tasks are the most popular and widely used of these tools in the literature (Frith & Corcoran, 1996). Wimmer and Perner (1983) administered the Unexpected Transfer Task, which served as the first illustration of a fundamental first-order false belief task. The Unexpected Transfer Task was used to evaluate how well participants could read the thoughts of others. Afterwards, to assess first-order false belief comprehension abilities, the Appearance Reality and Unexpected Contents Task was created in 1983 and 1986, respectively (Flavell et al., 1983; Hogrefe et al., 1986).

In addition to the first-order false belief task, a third individual is added to the situation in the second-order false belief comprehension skill. As a result, it is the person's capacity to understand the ideas of another about the ideas of another (Bach et al., 2000). Compared to the first-order false belief comprehension skill, the second-order false belief

comprehension skill is thought to be comparatively more challenging. The participant must mentally represent both the second person's mental states and the third person's false belief about the second person's belief state to complete the second-order false belief task (Stone and colleagues 1998). Second-order false-belief tasks include the use of stories and scenarios. One of these stories is the Martha-Oliver Story that Stone and colleagues (1998) produced and included in Table 1. However, ToM encompasses not only recursive belief attribution but also the interpretation of non-literal communication found in everyday social interactions.

Since these indirect language examinations require understanding and interpreting word meanings other than their literal meaning, they are more advanced and complicated activities (Corcoran et al., 1995). According to Sprong and colleagues (2007), a variety of activities involving faux pas, irony, metaphors, bluffs, and white lies are used to assess people's comprehension of the true meaning behind the words in this context. To assess the ToM abilities of children with high-functioning autism, Happé devised the strange stories task in 1994. These 24 stories include higher-level concepts, including humor, irony comprehension, white lies, and metaphors and allusions (Happé, 1994). Similarly, the faux pas exam was administered to children between the ages of 7 and 11 to assess their understanding of mistakes (Baron-Cohen et al., 1999). There are 26 questions on this difficult ToM evaluation, which requires awareness of mental states such as irony, white lies, intentionality, and misunderstanding. As can be seen in Table 1, another scenario involving faux pas was created by Stone et al. (1998) to target the detection of social slips.

In contrast to the verbal and narrative-based tasks described so far, other assessments focus on the visual decoding of mental states from facial cues. Mind Reading in the Eyes task, originally devised by Baron-Cohen and colleagues (1997), involves presenting the participant with a total of 25 images that solely feature the eye region of a face. The participant’s job is to conclude the subject’s mental state by selecting the one adjective that most accurately depicts their thoughts or emotions. Participants are asked to select one. Participant needs to be able to match terms with the eyes and have terms that represent certain mental states. Yıldırım and colleagues (2011) conducted a reliability study of the Mind Reading Task in the Eyes, which is widely used in Turkish literature and ToM research. The task was applied to 117 healthy volunteers and then re-administered to 70 volunteers to evaluate test-retest reliability. The findings show that there is no significant difference in the correct answer averages of the task between the two applications and that the number of correct answers increases as the education level increases. Additionally, it was determined that the reliability of the task increased further by excluding items with low reliability coefficients.

These traditional tasks used to measure ToM have been criticized regarding their contribution to understanding ToM skills, as well as their validity and scope. Both first and second-order false belief tasks have received much criticism. Researchers note that these tasks rely too heavily on a person's verbal skills and executive functions, and do not truly test their ability to make social inferences (Apperly, 2012; Milligan et al., 2007). Therefore,

children with limited language development or individuals with cognitive impairments may receive artificially low ToM scores, not because of a lack of social understanding, but because the tasks do not actually measure it. Linguistic tasks, such as tests of irony or gaffes, challenge more complex mental inferences. However, these tests often also consider factors unrelated to ToM, such as a person's cultural background, pragmatic skills, or vocabulary (Martin & McDonald, 2003). The "Eye-to-Mind Reading Task" also has its own problems. People might confuse it with simpler things like recognizing facial expressions or simply demonstrating basic empathy (Oakley et al., 2016). Most of these tests are static. They do not reflect the constantly changing, reciprocal nature of real social interaction (Zaki & Ochsner, 2011; Alcala-Lopez et al., 2018). Therefore, recent studies advocate multidimensional approaches using neuroimaging data to obtain a more complete and accurate picture of ToM (Schurz et al., 2014). Schaafsma and colleagues (2015) examined activation patterns from 73 neuroimaging studies encompassing six different groups of tasks within the ToM framework. An activation map largely overlapping with published meta-analyses was observed. However, a task-based clustering activation map showed divergences. Traditional tasks examine different components of ToM. Therefore, using only one task in studies may not provide a complete measure of ToM, but rather capture a single component. To capture today's multidisciplinary understanding, a comprehensive battery for ToM is needed.

Table 1: Examples of ToM Tasks

Tasks		Scenarios	Questions	Answers
First-Order False Belief Task	Sally-Anne Story (Baron-Cohen et al., 1985)	Anne and Sally are two characters. After placing one marble in its own box, Sally leaves. The marble is moved by Anne, who places it in its own box. Then Sally comes back.	Where is Sally going to seek her marble?	The correct answer is Sally's original location of the marble. Choosing the current location indicates failure to consider Sally's belief.
Second-Order False Belief Task	Martha-Oliver Story (Stone et al., 1998)	Martha and Oliver talk in the kitchen while Oliver eats cookies. After Oliver leaves, Martha moves the cookies to the cabinet. Oliver secretly watches this through the keyhole	Belief question: Where does Martha think that Oliver thinks the cookies are?	The correct answer to the belief question is on the table.
			Reality question: Where are the cookies?	The correct answer to the reality question is in the cabinet.

		before re-entering the room.	Memory question: Where were the cookies in the beginning? Inference question: Where would there be cookie crumbs?	The correct answer to the memory question is in the table. The correct answer to the inference question is on the table or on the floor.
Linguistic Task	Faux Pas Task (Stone et al., 1998)	Anne receives many wedding gifts, including a crystal bowl from Jeanette. Later, Jeanette accidentally breaks it. Anne replies, 'It doesn't matter, I never liked that wedding gift,' unknowingly hurting Jeanette.	Firstly, has anyone in this situation said something they shouldn't have said? Secondly, who mentioned something inappropriate for her to say? Thirdly, why wasn't Anne supposed to say what she said?	The first question is to assess the detection of faux pas. The second question also assesses comprehension of faux pas. To answer the third question, it is also necessary to comprehend the listener's mental

6. TOM AND LANGUAGE

ToM tasks are largely language-dependent. Consequently, the relationship between linguistic ability and ToM has become a central focus of developmental research, with numerous studies demonstrating a strong association between the two (Astington et al., 2002; Milligan et al., 2007).

However, debate continues regarding which specific linguistic components, pragmatics, semantics, or syntax, are critical in ToM development and regarding the direction of this relationship. One perspective emphasizes the role of pragmatics, suggesting that the understanding of mental states stems from the social use of language (Peterson & Siegel, 1995). To investigate this, Ruffman and colleagues (2002) examined the impact of mother–child discourse on ToM development. Their findings showed that mothers' frequent use of mental-state language during conversation significantly predicted their children's later ToM competence. Lexical-semantic knowledge, including children's understanding and use of mental-state terms such as *think*, *know*, and *believe*, may also contribute to ToM

development. A third perspective highlights syntax. De Villiers and de Villiers (2014) argue that acquiring sentential complement structures, such as "He thinks that…," provides children with a linguistic means of representing propositions that may differ from reality, thereby supporting false-belief understanding. More broadly, Richardson and colleagues (2020) found that delayed access to a first language was associated with poorer performance on linguistic ToM tasks and reduced neural selectivity in ToM-related regions, suggesting that early linguistic experience contributes to ToM development. Beyond identifying specific linguistic components, theoretical debate continues regarding the causal direction of the relationship between language and ToM. One possibility is that early social understanding supports language acquisition by helping children identify speakers' referential intentions and determine the meanings of new words (Baldwin & Moses, 2001). A second possibility is that language development supports ToM by providing children with the lexical and syntactic resources needed to represent mental states and false beliefs. Consistent with this account, Schick and colleagues (2007) found that ToM performance in deaf children was closely related to language ability. A third possibility is that the relationship is bidirectional or partly explained by shared cognitive mechanisms, such as working memory and executive functions. Indeed, longitudinal evidence suggests that language and ToM may influence one another over development rather than operating through a simple, unidirectional causal pathway (Slade & Ruffman, 2005).

Currently, there is no definitive consensus on the precise direction and nature of the relationship between ToM and language. While some researchers suggest that linguistic components, particularly syntax and pragmatics, facilitate the representation and communication of mental states (de Villiers & Pyers, 2002; Milligan et al., 2007), others argue that both language and ToM development are supported by shared cognitive mechanisms, including executive functions and working memory (Carlson et al., 2002; Hughes & Ensor, 2007). Longitudinal findings further suggest that the relationship is dynamic and reciprocal across development (Ebert, 2020).

7. NEURAL CORRELATES OF TOM

Essentially, two types of neuroimaging research examine brain regions associated with ToM. The first involves imaging studies on healthy individuals, while the second involves testing individuals with neurological disorders.

According to Frith and Frith (2003), the three main regions involved in mentalization are the temporal poles (TP), the temporoparietal junction (TPJ), and the medial prefrontal cortex (mPFC). Recent large-scale meta-analyses have largely confirmed this core triad while also expanding our understanding of subspecialties (Schurz et al., 2014; Molenberghs et al., 2016). Functional neuroimaging studies have systematically characterized the neural architecture underlying ToM, identifying a distributed network supported by the mPFC. Early PET studies by Fletcher and colleagues (1995) revealed selective activation of the left mPFC during mentalization narratives in healthy individuals, a pattern not prominently

present in individuals with Asperger Syndrome (Happé et al., 1996). Importantly, this mPFC activation appears to be task-independent; overlapping activations have been observed across various modalities, including the interpretation of historical figures (Goel et al., 1995) and nonverbal caricatures (Gallagher et al., 2000). Beyond this prefrontal region, the mentalization network extends to temporal and subcortical regions essential for intention attribution and perspective-taking. Brunet and colleagues (2000) identified a broad network related to intention attribution, which consists of the inferior prefrontal cortex, temporal gyri, anterior cingulate cortex (ACC), and particularly the left cerebellum. Recent insights into this traditionally overlooked network suggest that the posterior cerebellum (Crus I/II) acts as a critical node in the sequencing of social events (Van Overwalle et al., 2020). Furthermore, Vogeley and colleagues (2001) emphasized the specific involvement of the TP and cingulate cortex during the simulation of self-other mental states. Complementing these cognitive regions are the limbic and paralimbic structures, which mediate the emotional, social, and perceptual components of ToM. Baron-Cohen and colleagues (1999) and Fine and colleagues (2001) demonstrated the critical role of the amygdala in deciphering mental states from sensory cues such as the eyes. Similarly, the orbitofrontal cortex (OFC) facilitates the integration of socially significant stimuli (Wicker et al., 2003); lesions in this region lead to deficits in subtle social judgment (e.g., recognizing "wrong behavior"), mirroring deficits observed in autism (Stone et al., 1998; Baron-Cohen et al., 1994). These separable findings culminate in the Dual Process Model, which separates affective and cognitive components. While Shamay-Tsoory and colleagues (2005) presented lesion-based evidence that the ventromedial prefrontal cortex (vmPFC) specializes for emotional ToM, Kalbe and colleagues (2010) demonstrated that the dorsolateral prefrontal cortex (dlPFC) supports cognitive ToM via transcranial magnetic stimulation. This separation is formalized in the Information Processing Model developed by Abu-Akel and Shamay-Tsoory (2011); this model proposes that mental state representations in the TPJ are transmitted to different processing streams via the superior temporal sulcus (STS) and precuneus: a ventral stream for emotional ToM (amygdala, OFC, vmPFC) and a dorsal stream for cognitive ToM (dorsal anterior cingulate cortex (dACC), dorsomedial prefrontal cortex (dmPFC), dlPFC), while executive integration takes place in the ACC.

Traditionally, social neuroscience has adopted a topological approach, mapping specific functions to isolated brain regions. However, the field is currently transitioning toward a connectomic perspective. Modern analyses indicate that the ToM network significantly overlaps with the Default Mode Network (DMN) (Mars et al., 2012; Li et al., 2014). While white matter structures for non-social cognition are well-characterized, our understanding of the tracts supporting social cognition is still evolving (Wang & Olson, 2018). Recognizing that standard functional magnetic resonance imaging (fMRI) analyses focusing solely on regional activity cannot capture network-level dynamics, recent research calls for a paradigm shift. Similarly, Thye and colleagues (2018) confirmed that while Affective and Cognitive ToM tasks engage distinct sub-networks, both frequently recruit

"core" regions like the mPFC, precuneus, and STS, necessitating a reassessment of neural correlates beyond simple modularity.

Understanding the 'where' in the brain helps us understand the 'when' in development. As these specific brain areas mature, they unlock the ability to move from basic instincts in infancy to complex social reasoning in childhood.

8. DEVELOPMENT OF TOM

Traditional language-based ToM tasks are not suitable for use with infants. Therefore, studies examining early Theory of Mind development typically rely on nonverbal paradigms, such as looking-time, anticipatory-looking, and helping tasks, to investigate infants' emerging sensitivity to others' mental states.

Infants tend to distinguish their mothers from other people. Symptoms like infants recognizing their mothers' voices from other people or staring at people for extended periods of time instead of things are explained as signs that the babies are beginning to comprehend the idea of humans at a young age (Wellman et al., 2001). A baby's understanding of the fact that individuals have minds as opposed to things helps them comprehend what it is to be human and is a sign that they are developing a ToM (Flavell, 2000). Through developmental abilities including pointing, joint attention, and imitation, an infant gains an understanding of intentionality and goal setting during the first year of life (Wellman, 2011). According to Brüne and Brüne-Cohrs (2006), once a baby has completed the first year, they may engage in role-playing games by learning to differentiate between representation and reality. This allows them to build meta-representation and progressively acquire mental state abilities. The ability to comprehend and grasp the thoughts, feelings, and viewpoints of others may be demonstrated through role-playing (Bergen, 2002).

Studies on ToM have focused on the concepts of beliefs (Sodian, 2005). Under these circumstances, the children must comprehend that several people might hold disparate opinions about the same circumstance and that these disparate beliefs can influence behavior (Wellman & Liu, 2004). When two people imagine the location of a chocolate bar, for instance, one imagines it to be on the table and the other in the refrigerator. People may behave differently depending on these divergent beliefs. Youngsters must learn that individuals behave not because of reality but rather because of their own beliefs, even when those beliefs are incorrect. Premack and Woodruff (1978) claim that for children's first-level belief transference to be deemed mature, they need to draw conclusions from seen events and respond appropriately. When nonverbal false-belief tasks are performed, research has shown that infants as young as 15 months old perform successfully (Onishi & Baillargeon, 2005). Children older than three years old can understand the first level of false belief, according to tests conducted on them (Brüne & Brüne-Cohrs, 2006; Frith & Frith, 2003). Research indicates that children as young as 4 years old begin to comprehend the beliefs of others (Baron-Cohen et al., 1985). Thus, between the ages of 3 and 5, there appears to be a notable advancement in the acquisition of false belief attribution. Children

start to consider other people's mental states at the age of six, which allows them to discern other people's beliefs and ideas. This suggests that second-order ToM abilities are developing (Brüne & Brüne-Cohrs, 2006). People who have developed second-order ToM abilities can comprehend metaphor and implication. Because the development of this talent is a more advanced ToM ability, the comprehension of irony, which involves a more complicated representation of the mental states of the speaker and the affected person, is thought to take until the ages of 9–11 (Brüne & Brüne-Cohrs, 2006). Research has demonstrated that ironic comprehension abilities are acquired at different ages for boys and girls. Specifically, females acquire these skills around the age of 9, whereas boys acquire them around the age of 11 (Baron-Cohen et al., 1999). However, recent replication failures warrant caution in interpreting these findings, suggesting that infants' responses may reflect behavioral rules or lower-level task strategies rather than full-fledged mental-state attribution (Crivello & Poulin-Dubois, 2019; Dörrenberg et al., 2018; Rakoczy, 2012).

In a study conducted with three different age groups during adolescence, a difference in ToM skills was observed in the older age group compared to the younger age group (Gabriel et al., 2019). Developmental growth in ToM skills has been found throughout adolescence and early adulthood, as assessed by the Faux Pas Test with participants aged 11 to 25 years (Meinhardt-Injac et al., 2020). On the other hand, it is seen that different results are obtained when ToM skills are measured at different ages. For instance, Happe and colleagues (1998)'s initial investigation on the ToM development in old age concluded that older people performed better on the ToM than younger people did. In a more recent study, Wang and Su (2006) conclude that while older people performed equally on certain ToM tests, they scored worse than younger people on others. These inconsistent findings may partly reflect differences in the tasks used to assess ToM. Nevertheless, meta-analytic evidence indicates that older adults generally perform more poorly than younger adults across a range of ToM tasks, domains, and presentation modalities (Henry et al., 2013).

While the developmental course of ToM has been widely supported by behavioral and neurodevelopmental research, several methodological and conceptual issues remain controversial. First, common ToM paradigms, such as false belief or faux pas, rely on verbal skills and explicit reasoning, which may lead to an underestimation of implicit mentalizing capacity in the prelinguistic period (Low & Perner, 2012). It is known that ToM abilities can vary across cultural, linguistic, and social environments (Perez-Zapata & Slaughter, 2014). Furthermore, the variability observed across age groups and task types (e.g., Wang & Su, 2006) suggests that ToM may not be a single construct but rather a system composed of interacting cognitive and affective components that mature at different rates (Oakley et al., 2016). Therefore, while developmental findings provide an important framework, these results must be considered in the context of task types, sociocultural influences, and the multicomponent structure of ToM.

9. TOM AND CLINICAL PERSPECTIVES

Numerous clinical studies have been carried out to assess ToM abilities. Research involving autism and schizophrenia has been the most prevalent in the field of ToM and clinical psychology (Baez et al., 2015; Pickup & Frith, 2001). However, current perspectives suggest that ToM deficits are a transdiagnostic feature, manifesting in distinct profiles across the clinical spectrum (Cotter et al., 2018).

Leo Kanner initially defined autism as an emotional illness in 1943. Hans Asperger subsequently characterized autism, and it was thought to be a condition focused on interaction with others (Korkmaz, 1994). While the DSM-5 lists symptoms like repetitive motor movements and insistence on routine, the core deficits relevant to this context are impaired verbal and nonverbal communication, impairment in sharing, and difficulties in establishing and maintaining relationships (Köroğlu, 2014). According to Rapin (1991), people with autism also struggle to interpret messages, body language, facial expressions, and tone variations in speech. Research has been done on the assumption that people with autism will struggle with ToM abilities specifically because they struggle with social communication. This specific deficit profile is often referred to as "Mindblindness" or hypomentalizing, characterizing a failure to intuitively attribute mental states (Baron-Cohen, 1995). In their study, Silliman (2003) examined the variations in ToM skills between adolescents with autism and typically developing people. According to the study, those who were typically developing scored higher than people who had autism. In another study, Golan and colleagues (2006) developed a task that is more complex and aims to make references to mental states from video clips that depict slices of life. Children with autism received lower scores than typically developing children.

Schizophrenia is a mental disorder that causes individuals to experience problems in perceptual, cognitive, emotional, and behavioral areas, especially in distinguishing reality (Bademli & Duman, 2013). The major criteria for schizophrenia within the DSM-5 framework include delusions, hallucinations, disordered speech, and negative symptoms (American Psychiatric Association, 2013). It has been proposed that a ToM deficit may be linked to some psychotic symptoms observed in schizophrenia (Frith, 2014). Because of this, several studies have been carried out to assess the ToM abilities of people who have been diagnosed with schizophrenia. Unlike autism, this typically involves an over-attribution of intentions, or "hypermentalizing," where patients perceive agency where there is none (Frith, 1992). Mazza and colleagues (2001) compared the ToM abilities of participants diagnosed with schizophrenia and control groups using scenarios involving deceit and false beliefs. In all ToM scenarios, the results demonstrate a substantial difference between schizophrenia and normal controls, with schizophrenia patients doing worse than controls. Wang and colleagues (2015) produced research with more thorough results. It has been demonstrated that people with schizophrenia show insufficient ToM abilities, specifically in comprehending the mental states of others.

Beyond these two primary conditions, ToM deficits appear in other disorders with unique characteristics. For instance, individuals with borderline personality disorder show a "mentalizing paradox," characterized by heightened sensitivity to emotions but a biased,

negative cognitive interpretation of them (Sharp et al., 2011). Similarly, Frontotemporal Dementia offers a lesion model in which vmPFC atrophy results in a profound, acquired loss of affective empathy (Gregory et al., 2002).

ToM is frequently used in research to understand social cognition in psychopathology. Autism and schizophrenia offer different models for ToM in clinical presentations (Crespi & Badcock, 2008). ToM deficits in autism are considered a developmental deficit. In these individuals, the ability to understand others' beliefs, intentions, and emotions remains fundamentally impaired, resulting in significant difficulties in social communication. In contrast, ToM impairments observed in schizophrenia more commonly manifest as cognitive functional disorganization; patients often tend to over-interpret, misinterpret, or perceive others' intentions as threatening. Therefore, ToM deficits in autism are described as a pattern of "hypomentalization," while those in schizophrenia are often described as a pattern of "hypermentalization" (Abu-Akel & Bailey, 2000; Crespi & Badcock, 2008). This contrast demonstrates that ToM is a multidimensional mechanism with both neurodevelopmental and neurodynamic components. From a general perspective, these different ToM profiles indicate that similar performance deficits can stem from different underlying impairments in social cognitive processes (Eack et al., 2017).

10. TOM RESEARCH in TÜRKİYE

Many important studies on understanding and explaining cognitive processes have contributed to the enrichment of the ToM field in Türkiye. Some of these studies have addressed ToM from a developmental perspective (Karakelle & Ertuğrul, 2012; Küçük, 2018; Ertuğrul Yaşar, 2022). Extensive analyses have been conducted in this field on language acquisition, mental processes changing from infancy to maturity, and related issues. Recent studies, particularly in Turkish samples, have strengthened the link between language, executive functions, and ToM. For example, a study by Kılıç-Tülü (2025) revealed that ToM performance in children with Autism Spectrum Disorder (ASD) is strongly correlated with language development and social communication skills, highlighting the significant impact of linguistic abilities. Furthermore, Toker and Acarlar (2025) emphasized that ToM skills in children with ASD are closely related to executive functions, particularly highlighting the role of inhibition and cognitive flexibility. A study by Aslankara (2019) proposed a close but not complete overlap between executive functions and ToM; it showed that executive functions are necessary for the execution of certain components of ToM (e.g., attention, inhibition, working memory), but insufficient to explain the holistic functioning of ToM.

The relationship between ToM and pathological conditions is also a subject of research. A significant portion of research in this area focuses on mental processes associated with disorders such as autism and schizophrenia (Kaysılı, 2013). This research, using examples of pathological conditions, provides insight into the clinical and applied characteristics of ToM, which is crucial for understanding individual differences and mental health issues.

In addition, significant progress has been made in the development of cultural adaptation and measurement tools. Studies have been conducted on the applicability, validity, and reliability of tasks and tests evaluating ToM in Turkish culture. Sarı (2011) adapted stories designed to measure ToM skills to Türkiye. Tülü and Ergül (2022) developed a new material called the Theory of Mind Test Battery for Children. Furthermore, Kademli and Cangöz Tavat (2025) developed the Hacettepe Computer-Based Theory of Mind Battery to assess ToM skills, and its validity was also examined. Değirmencioğlu and colleagues (2018) developed the Dokuz Eylül Theory of Mind Scale for Schizophrenia Patients with a more specific sample study for individuals diagnosed with schizophrenia. The development of these tools allows for more valid and reliable assessments, taking cultural differences into account.

In conclusion, ToM research in Türkiye offers significant findings from both clinical and cultural perspectives. The effects of psychopathological conditions such as autism and schizophrenia on ToM skills are examined in relation to language development, executive functions, and cultural factors. This has made significant contributions to revealing the structure of ToM. Furthermore, studies on the cultural validity and reliability of ToM tools contribute to more accurate and valid evaluations. Developments in this area are important both for clinical practice and for the development of culturally compatible assessment tools.

11. CURRENT DISCUSSIONS

The study of ToM has evolved from philosophical speculation to a rigorous empirical science, currently navigating pivotal discussions across methodological, evolutionary, and neuroscientific frontiers. Historically, Astington (2001) posited that ToM research should focus on improving our understanding of beliefs and intentions, emphasizing the critical role of language and the development of children's understanding of their own mental states. These suggestions contributed significantly to the surge in studies focusing on false belief tasks (Poulin-Dubois, 2020). However, as literature accumulated, definitions began to diverge, leading to a consensus that ToM measurements must align more precisely with theoretical underpinnings.

This divergence has precipitated what is often described as a validity problem. According to Quesque and Rossetti (2020), researchers are now urging for tasks that strictly separate true mentalizing from lower-level processes; successful performance on a ToM task should not be explained by simpler mechanisms like attentional orientation. Furthermore, recent debates highlight a "replication crisis" specifically in implicit ToM tasks, suggesting that spontaneous mentalizing might rely on different cognitive systems than explicit verbal reasoning (Kulke et al., 2018; Grosse Wiesmann et al., 2017). Parallel to these measurement debates, individual differences in ToM are being re-examined, particularly in how they relate to social learning. Recent work suggests that even infants' emerging ToM skills predict their ability to detect poor informants and avoid learning from them (Crivello & Poulin-Dubois, 2019).

Discussions have also expanded beyond the human species, highlighting a profound evolutionary continuity. ToM studies on animals have increased significantly, examining the roles of language, culture, and executive functions in an evolutionary context. Research has made great progress in determining the social cognitive capacities of diverse species, from crows to primates. Recent advances have further blurred the boundaries between human and animal cognition, raising the possibility that even rich ToM capabilities, such as understanding subjective desires and false beliefs, may not be unique to our species (Krupenye & Call, 2019). Consequently, current research aims to clarify to what extent the motivational and cognitive foundations of ToM are truly specific to humans (Melis et al., 2013).

In the field of neuroscience, the focus is evolving from the localization of functions to understanding network dynamics. According to Wellman (2018), ToM skills should be addressed with a lifelong approach encompassing preschool false belief tasks, infancy, aging, and gene-environment interactions. However, Bowman and Wellman (2014) argue that direct neurocognitive studies with young children are necessary, pointing to the presence of a ToM network that can be found in the developing brain. Furthermore, the field is expanding beyond correlational inferences to include patient models to determine the causal necessity of specific regions for ToM (Yeh & Tsai, 2014).

From a network architecture perspective, modern analyses show that the ToM network overlaps significantly with the Default Mode Network (DMN) (Mars et al., 2012; Li et al., 2014). While the white matter structures of non-social cognitive processes are well-defined, research on pathways supporting social cognition is still limited (Wang & Olson, 2018). The existence of a single ToM network is a controversial topic in the literature (Schaafsma et al., 2015). In this context, Thye and colleagues (2018) revealed that emotional and cognitive ToM tasks utilize different subnetworks, but both intersect in "core" regions such as the mPFC, precuneus, and STS.

Future studies are expected to stem from understanding the interaction of these large-scale networks rather than the discovery of new brain regions. For example, Schurz and colleagues (2021) observed that cognitive ToM tasks are frequently activated along with the DMN, while emotional ToM tasks involve patterns that include both the Ventral Attention Network (VAN) and the DMN. More importantly, current consensus reports now integrate subcortical structures into this model; The critical role of the cerebellum in automating social prediction sequences within these cortical networks is particularly emphasized (Van Overwalle et al., 2020). All these findings demonstrate that social cognition relies, and should rely, on the dynamic interaction of intrinsic connection networks rather than isolated modules.

In conclusion, ToM is not a monolithic ability but a multidimensional system dependent on language, shaped by culture, grounded in dynamic neural networks, and vulnerable to distinct forms of pathology. What began as observations of animal cognition has evolved into a broad theoretical framework encompassing attention, emotion, and intention. As we

move forward, integrating computational models with cross-cultural studies will be key to unraveling how the brain bridges the gap between self and other.

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The principles of research and publication ethics of the Manisa Celal Bayar University Journal of Social Sciences were adhered to throughout all stages of this study.

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The contribution of the first author to the manuscript was 60%, the second author contributed 30%, and the third author contributed 10%.

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The authors declare that they have no conflict of interest with any individual or organization.

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