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Mindreading in altruists and psychopaths

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Abstract
Due to its importance in political, cultural, and clinical spheres, adult mindreading needs to be investigated (and understood) in depth. This chapter introduces the various meanings of "mindreading" in neurotypical adults. We highlight philosophical and psychological implications of this construct for a wide variety of specifically human social interactions, such as play, acting, and manipulation. As a general rule, humans see one another as centres of intentional gravity and are very good folk psychologists (i.e., predictors of others' behaviors). These predictive powers rest in no small part on our various abilities to mind-read. A centre of intentional gravity can be decomposed into concepts such as beliefs, desires, motives, and can have multiple orders of understanding (e.g., "he believes that she desires him to wish for…"). Such multi-layered abilities underwrite a vast range of human cognitive and affective domains such as mimicry, altruism, empathy, psychopathy and learning. Our ability to attribute independent mental states and processes to others, as well as to animals and inanimate objects, is an integral part of human social behavior, but mindreading alone has no necessary internal moral compass, as seen in the behavior of altruists and psychopaths. Rather, mindreading is presented here as an all-encompassing toolkit that enables us to navigate our *Umwelt* as effectively as possible.

Keywords: mindreading, theory of mind, altruism, empathy, psychopathy, social cognition, mind attribution.

1. Introduction

Complex social species require sophisticated communication systems to navigate through the intricacies of social interactions and to establish and maintain long-lasting relationships crucial for mutual fitness. To this aim, the human brain, an interconnected network of billions of neurones and glial cells, integrates externally-acquired with internally-stored information to render it meaningful in different social contexts. The ability to predict intention and response is observed in core social interactions (be they altruistic, mutual, selfish, or spiteful) generally available to all social organisms, although organisms unable to predict the intentions of conspecifics can also act in those ways. In this chapter, we discuss philosophical, psychological, neurological, and methodological aspects intrinsic to mindreading in neurotypical adults and their links with altruism and psychopathy in social contexts.

2. Conceptual considerations about minds

A naïve appraisal of the importance of evolutionary insights to the understanding of brains might incline us to believe that organisms evolved to have composite perceptual systems that give truthful information about the external world. However, a moment's reflection should reveal that the possible set of truths about external reality is computationally intractable. As a result, organisms do not see the "true world" because this would overwhelm them, not least in terms of energy consumption and processing speed. Instead, organisms evolved to have brains (which in these terms are primarily prediction machines) that yield useful information to increase fitness in the broad ecology of threats and opportunities in which that organism has evolved, the so-called *Umwelt*—a set of environmental factors affecting the behaviour of living things (1). This distinction is crucial, and it is not unique to biology, or to neuroscience. In artificial intelligence, the difficulty of filtering out what is irrelevant to focus on what is computationally tractable in its broadest sense is called "the frame problem" (2, 3). Minds are things that brains "do", which includes the wider neurophysiological system embedded in an ecology. Contemporary scholars want to ask deeper questions about these various functions, even when philosophical issues continue to bedevil such enquiries.

Do minds exist separately from bodies? While almost no-one today would openly describe themselves as a Cartesian dualist regarding the mind/body problem, almost everyone is a *de facto* dualist when it comes to attributing minds to other humans or even certain non-humans. Why do intuitions like this persist when neuroscience repeatedly tells us that there is no "ghost in the machine" (4)? Part of the answer is that this conceptual mistake is actually a trick (sometimes called a "Baldwin effect") (5) that allows us to make fairly reliable predictions about other creatures in our *Umwelt*. For a complex eusocial species like ourselves, the most salient features of our *Umwelt* are other humans, and seeing each separate human as a seat of intentional gravity is a crucial part of our survival toolkits. In other words, our incredibly successful folk psychology keeps running up against our (now) substantial scientific knowledge, putting our intuitions under pressure.

Useful distinctions have been made between "stances" in the world: physical, design, and intentional levels (6). A goal of science is to enable meaningful transitions between these descriptive levels but, as a bare minimum requirement, separate valid scientific descriptions must be able to co-exist logically, or, to use Wilson's (7) term, be consilient. At the most basic level is the physical description of a phenomenon. For instance, a cup of hot coffee has billions of sub-atomic particles moving randomly in a liquid and generating kinetic energy (i.e., heat). Coffee contains caffeine, which did not evolve to give us humans a morning boost, but rather as an insecticide for the coffee plant (design stance); the stimulating effect it

has on our brains is a by-product. If we then want to explain why many of us crave a morning coffee, we need to move from design to an intentional stance by stating our goals (e.g., getting an urgent task finished on time). These goals, desires, and intentions allow meaningful predictions of our actions in a way that a physical description of our brain cannot (and likely never will) achieve.

It should be obvious from the foregoing that most attempts to either produce or rebut so-called reductionist explanations of events are misguided. Attempts at explaining our need for a hot morning coffee in kinetic or biochemical terms would leave out our intentions and desires. This intentional level is the level of mindreading. As Minsky (8) notes, there is no particular reason to think that we will ever be able to give a complete and useful description of human actions regarding the physical level of description of brain chemistry and neurotransmitter firing alone.

Given that the human brain evolved to solve a set of problems using whatever tools were available to evolution to build functional systems, the resulting brain consists of a vast network of complex interconnected and dynamic mechanisms. It is precisely the interface between the mechanisms evolved to promote fitness and the information that makes sense as folk psychology that needs to be understood (and implemented) to enable successful social exchanges. Integral to such social behavior is our ability to attribute independent mental states and processes to the self and to others, as discussed below.

3. Mindreading

Mindreading is often referred to through a range of terms, such as "theory of mind", "social intelligence", "social cognition", "mentalizing", "mind attribution", "cognitive and affective mentalizing", and "hot and cold empathy" (see Kumfor et al, this volume). Although each of those terms can be characterised individually, they all refer to some core and overlapping features. Zaki and Ochsner (9) grouped the features common to all those terms into (i) experience sharing, (ii) mentalizing, and (iii) prosocial concern.

While a useful shorthand, the term mindreading conceals a great deal of complexity. Essentially, mindreading refers to our ability to navigate social interactions, i.e., our ability to attribute mental states to others and make conjectures about their goals, beliefs, and intentions, usually with the aim to understand, modulate or manipulate their behavior (10-12). Individuals might differ in their ability to understand the mental states of others, but such differences are not associated with the recall of events and facts related to them; rather it is the complexity of other people's mental lives that imposes a cognitive limit for mindreading (13).

Until recently, mindreading research was underpinned by two so-called "theories": Theory Theory (TT) and Simulation Theory (ST). TT refers to how mental states are interconnected when monitoring human actions, whereas ST refers to the ability to simulate the mental states of others and activate one's decision-making system, which in turn results in the attribution of beliefs and desires to the person we are trying to understand (14). If such simulations are employed as frequently and as explicitly as ST proposes, we would expect to be aware of those mental states. Since that does not seem to be the case, mixed TT-ST models have been adopted to study mindreading (15). One reason for thinking that the term "theory of mind" can mislead here is that what is done by humans is so "natural" that it is nothing like the formal theories of (say) Newton, and what is meant varies considerably across domains. Consider Wittgenstein's (16) oft-requoted assertion: "My attitude towards him is an attitude towards a soul. I am not of the opinion that he has a soul." Wittgenstein is denying the idea that we set out a list of properties and capacities before deciding whether to treat someone as human. In addition, we do not need to have a formal belief in life after death to have a conception of someone that includes nested assumptions about attitudes,

connections, and a moral life which can have continuity and meaning. In brief, we treat other humans as being in the intentional stance (6).

At the other end of the scale of mind-ascription, the term "mind attribution" expands the definition of mindreading to include animals, inanimate objects, and imaginary entities (e.g., gadgets, Gods) (17). For example, mind attribution can be seen in pet owners who appear to engage in long conversations with their pets, which seem to benefit the pet owner's well-being (18-20). Some animals can indeed be understood at the intentional level (e.g., "Bilu wants to go for a walk"), and there is nothing odd or unnatural about such uses. It becomes somewhat trickier to be sure what is meant if the situation is reversed (e.g., "Bilu understands every word I say") and there is certainly a degree of overspill of recursive attribution of mindreading at this level.

3.1. Cognitive and affective mindreading

Mindreading is often subdivided into its cognitive and affective aspects, making allowances for the dissociation of those two dimensions at the neural level (21-24). The awareness of thoughts, creeds, and intentions in oneself and others is known as cognitive mindreading, which includes different levels of meta-representation: "first order" (e.g., I think X understands the problem) or "second order" (e.g., I think X believes that Y understands the problem) (Figure 1). There is a ceiling to how many iterations of orders (belief about a belief about a belief) the human mind can manifest. Most researchers think that five levels are the human limit (25), although some have documented up to eight such levels (26). Affective mindreading, on the other hand, refers to the ability to experience, to some degree, the emotional inner lives of other individuals without necessarily sharing any of their emotions or feelings (27, 28).

3.2. Empathy and mimicry

Our ascription of intentional states is not merely a function of successfully predicting the behaviour of others –important though this is. It is intimately connected to our ability to learn as individuals. In many social contexts, empathy and mimicry can be intertwined with mindreading and it is not easy to disentangle them. Mimicry is seen as a possible precursor of or direct contributor to mindreading, since inferences about others' mental states may have evolved from the ability to predict others' actions (29). Empathy is a more complex construct; it refers not only to our awareness of thoughts and intentions in fellow humans but also to our ability to understand their emotional states and predict others' actions (29). It is a multi-layered ability to vicariously experience and understand mental states in oneself and others, i.e., the sharing of feelings and emotions linked to mental state attribution (30).

The role of mindreading and empathy in social cognition (especially related to culture and politics) is under-explored given that the social environment in which one grows up is essential to the development of those abilities (31). That role in moral judgments, actions, and deliberations has been the focus of recent and intense discussion. Mindreading and empathic abilities have been overwhelmingly associated with pro-sociality and beneficial outcomes, even though that is not always the case (32-34).

The overlap between mindreading and empathy descriptions is exemplified by studies suggesting the subdivision of empathy into two broad subtypes, namely "cold" and "hot" (35). Cold empathy resembles "cognitive mindreading" in that it refers to the ability to take the perspective of other individuals (to understand their feelings, problems, and sorrows) while being able to avoid sharing their emotional states. Conversely, hot empathy resembles

"affective mindreading"; individuals able to experience hot empathy share the affective mental state of others, and they seem sufficiently motivated to help others when needed.

Mimicry is critical to learning in humans and other animals. We usually expect people to be able to "read" our intentions from our actions, yet some of this ability is opaque to ourselves. This allows, for example, actors to surprise us with their superior ability to convey (or conceal) intentions. In addition to straightforward acting, professional psychics and mindreaders (in the sense of conjurors) can only entertain and surprise us because they push the boundaries of what we usually consider the limits of such intentional and informational mindreading ability. It is not possible to perform psychic routines on other animals, however. There is no comparable version of "Was this the card you were thinking of?" which will surprise your pet (36). The example may appear obvious –and in many ways, it is– but it underscores how naturally and regularly humans swim in a world of (circumscribed) intentionality.

3.3. Neural representation of mindreading

Due to the wide range of behavioral and physiological levels of processing it involves, mindreading engages an extensive brain network of exogenous and endogenous mechanisms. Gerrans and Stone (37) point to evidence in favour of a domain-specific nervous mindreading module with a parsimonious cognitive architecture that integrates domain-general and lower-level domain-specific mechanisms, which underlie flexible and sophisticate behaviours.

The neurobiology of inter-subjectivity has revealed the existence of extended and overlapping networks during the sharing of experiences (empathy) and mindreading. Mapping studies investigating neuronal activation during mindreading showed that the brain areas most commonly activated were also linked to moral and social behaviors. The network involved in mindreading is frequently reviewed and updated, usually in tandem with the advance of brain mapping technology and assorted experimental paradigms (e.g., short stories, cartoons, explicit and implicit mindreading instructions), which did not seem to account for the variations reported in the findings.

Several studies confirmed that a wide brain network is activated during mindreading, indicating the existence of core brain regions –including parts of the prefrontal cortex (PFC) and superior temporal sulcus (STS)– in addition to "peripheral" regions (38). Currently, the mindreading network includes the temporal cortex (TC), the posterior STS (pSTS), the amygdala, the dorsomedial and ventromedial prefrontal cortices (dMPFC and vMPFC), the temporal pole (TP), and the temporoparietal junction (TPJ) (39-43). For instance, activity of the TPJ is linked to the understanding of our emotions in connection with specific events or individuals and such cognition-emotion link seems to modulate morally-sound decision-making outcomes (44, 45). The precuneus/posterior cingulate (PCC) was also activated during mindreading, chiefly when one is thinking about intentions and beliefs (41, 46, 47). Cross-cultural variability was observed in the activation of the TP and the TPJ, in line with behavioral differences across individuals from different cultures (e.g., American, French, Japanese) (48).

The mechanism underlying the ability to share experiences also relies on distributed brain networks (49). Some of the most consistent findings related to the sharing of experiences recorded at the behavioral (self-reports) and neural levels (functional magnetic resonance imaging, fMRI) come from pain studies. The brain regions activated when we witness others suffering are the same areas activated when we are suffering ourselves: the anterior insula (AI) and the middle anterior cingulate cortex (mACC) (50, 51). Moreover, a study using games with simulations of realistic environments (virtual reality) revealed that the right AI seems enlarged in individuals willing to risk their virtual lives attempting to rescue a person in danger (52).

Despite an extensive range of studies on the neural bases of mindreading on the one hand, and the related behavioral processes on the other, more studies are needed to bring together those two lines of enquiry. One example of such an extended approach can be seen in the study by Zaki, Weber, Bolger, and Ochsner (53), who reported that the neural activity in areas previously associated with mindreading matched participants' accuracy at inferring the affective state of another person. An improved understanding of mindreading in typical individuals is essential to the understanding of the sequelae of acute brain trauma, as well social cognitive dysfunction (see Piguet, this volume), which could lead to better neurorehabilitation programs (24).

The continuous development and improvement of methods for monitoring brain activity and social behaviour have contributed directly to the implementation of a multitude of useful experimental paradigms in mindreading studies. Below we give some examples of the most common experimental paradigms employed in mindreading research with typical and non-typical individuals.

4. Classical paradigms in mindreading

Below we describe some of the most common experimental paradigms used in brain imaging studies of mindreading. They include first-, second-, and up to fifth-order mental states of mindreading, although not all paradigms include all orders of mental state (Figure 1).

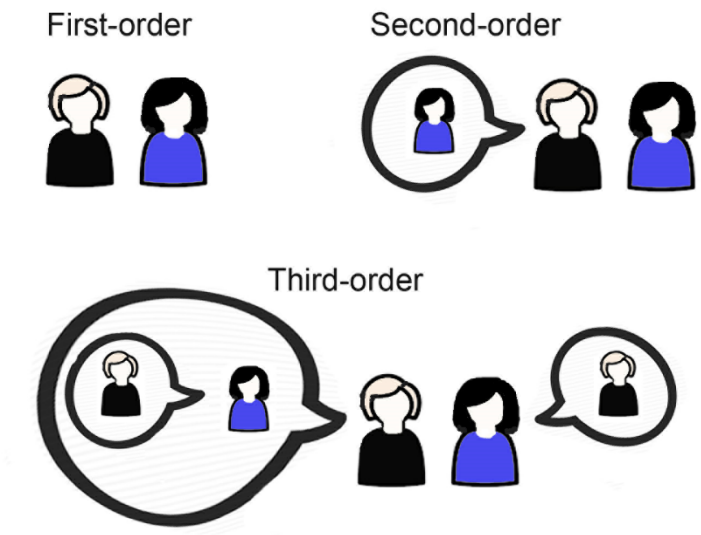

Figure 1. Schematic illustration of first-, second-, and third-order mental states.

4.1. Reading-the-Mind-in-the-Eyes Test

The Reading-the-Mind-in-the-Eyes Test (RMET) (54) involves the recognition of complex emotional states from photographs of faces where only the eyes area is visible. During the test, individuals see the eyes area of a face and must choose which of two affective labels ("ashamed", "indecisive", "nervous", "suspicious", etc.) better depicts the emotion displayed (Figure 2). A more recent study showed that there are no reliable gender differences in RMET responses (55). This task has been used to detect subtle impairments during affective processing (56, 57). Moreover, it has been partially successful at predicting affective social

deficits in children with autism spectrum Disorder (ASD) and sensitive enough to be used with typical adults. Notwithstanding, it has been argued that the RMET measures the ability of participants to identify complex emotions rather than mindreading *per se* (58).

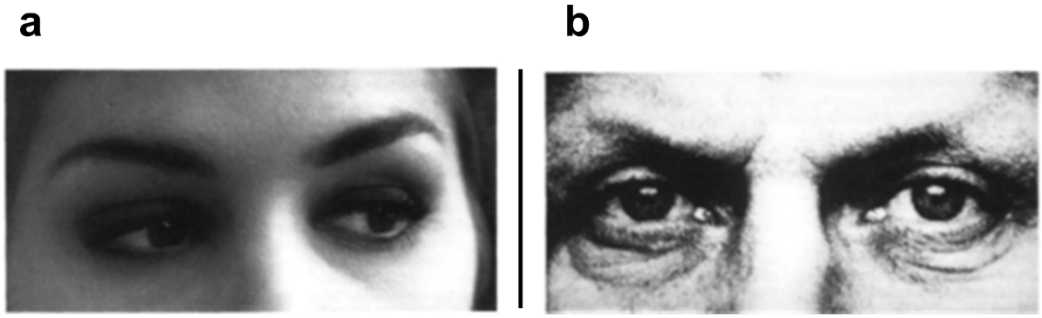

Figure 2. Examples of eye expressions used in the RMET. Examples of the choices of descriptions for the eye expressions in the images above: (a) concerned vs. unconcerned, and (b) serious message vs. playful message. The correct responses are underlined.

4.2. False belief task

The false belief task (FBT) (11) has been used to empirically explore cognitive mindreading. According to many researchers, FBT allows investigating whether individuals can distinguish between their own beliefs and those of another person (who is likely to have a different perspective) (59). An experimental paradigm used in many FBT studies is the Sally-Anne Test (Figure 3). Like other object-transfer paradigm, it uses social vignettes to depict belief-states. "Sally" (the target agent) and "Anne" are two puppets. Sally has a basket with an object in it, Anne has an empty box. Sally leaves the room, and Anne moves the object into her previously empty box. When Sally returns to the room the child is asked: "Where does Sally think the object is?". In other words, Sally wrongly believes that the object is in her box because she did not see that Anne has moved the object to the empty box (first-order mental state).

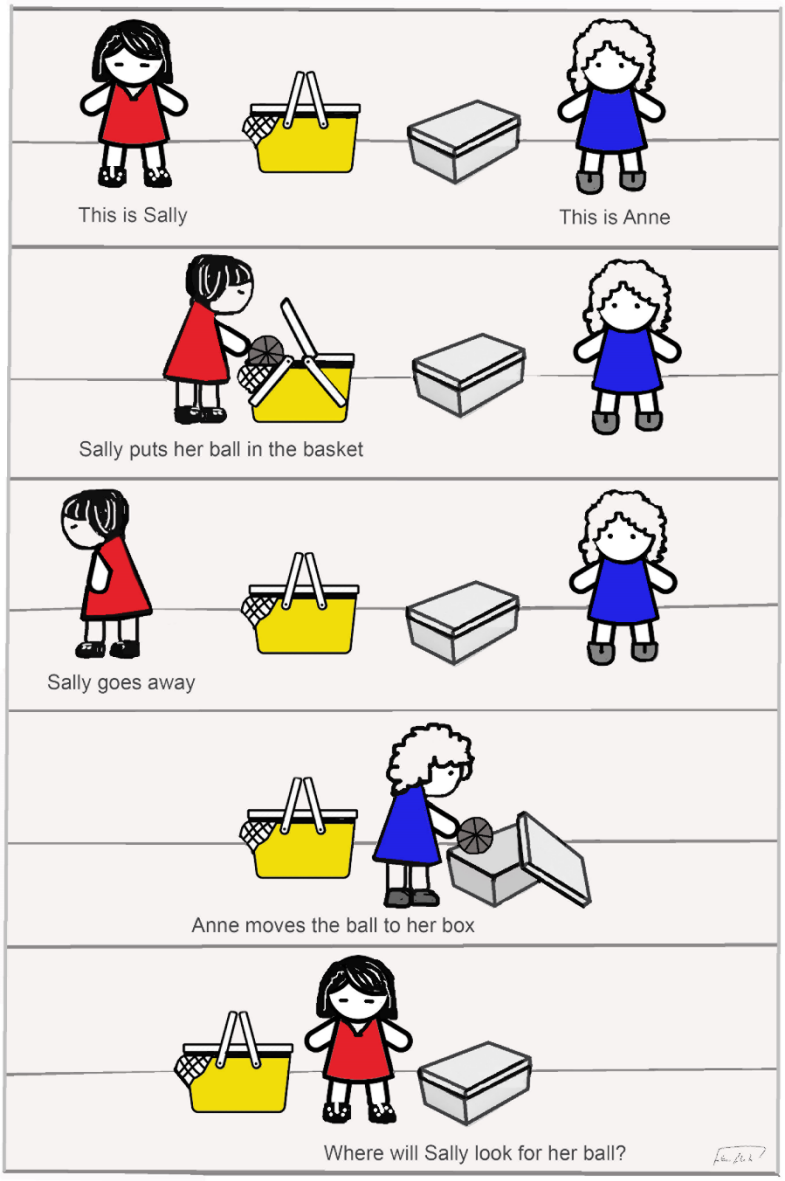

Figure 3. The Sally-Anne Task.

A typical child will realise that the action took place out of sight of Sally (second-order mental state), who should then have a mistaken belief that the object is where it was before she left the room, whereas most ASD children will conflate their own knowledge with that of Sally and maintain that she knows what they know (60). The validity of the classical FBT paradigm with adults has been called into question since adults show ceiling effects (100% accuracy) when performing it (61).

It is worth noting that the FBT and the RMET might be too simple to provide a more encompassing understanding of mindreading in typical adults. Hence, a more elaborated set of tests is still needed to investigate our ability to "mindread" and to empathise with others in terms of moral and social behaviors (62, 63).

4.3. The Yoni test

The Yoni test (22) is based on the "Charlie task" (60), and it incorporates visual and verbal cues. A central character, "Yoni" is represented by a happy cartoon face in the centre of an image surrounded by four images of a single category –e.g., animals, faces, and transport (Figure 4).

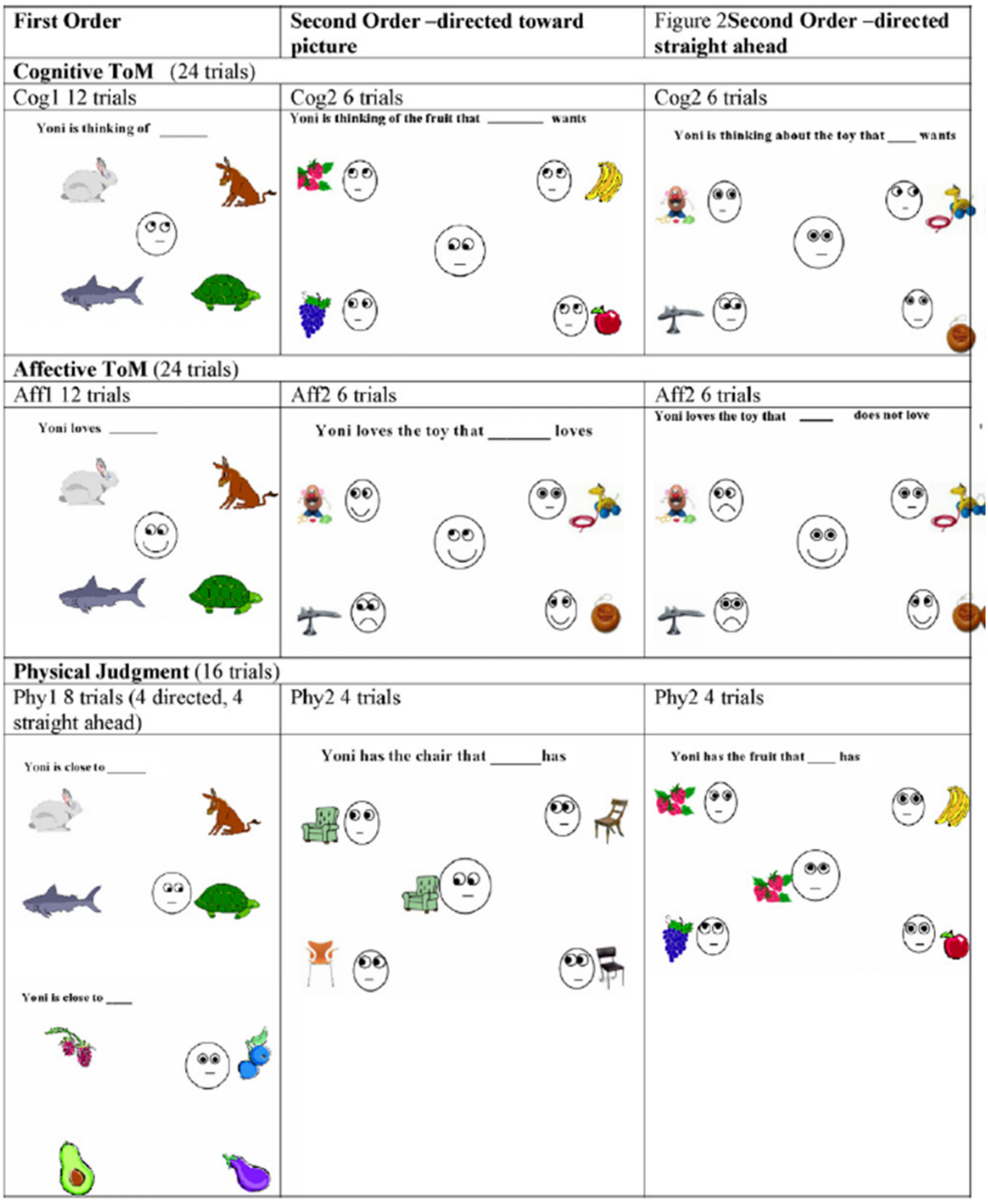

Figure 4. The Yoni test.

Individuals must indicate by mouse-clicking the image related to the social vignettes presented (first-order level): “Yoni is close to ____”, “Yoni loves____”, “Yoni does not love____”, “Yoni identifies with____”, or “Yoni thinks about____”. Second-order social vignettes refer to whose success Yoni envies, whose misfortune Yoni gloats over, and items Yoni thinks about, has or loves, that another character thinks about, has or loves. The test is suitable for interpretations of proximity, facial expressions, and gaze direction, and it allows measures of response accuracy and latency across affective, cognitive and physical (control) trials.

4.4. Animations: The Heider-Simmel illusion

The Heider-Simmel illusion (64) consists of a simple animation of a large triangle, which appears to pursue two small circles around a simple virtual landscape (Figure 5). Viewers naturally and unselfconsciously describe the scene regarding an “angry” triangle that “bullies” the smaller circles who are “frightened” of it, and so forth. Of course, at one level the viewers are perfectly well aware that triangles and circles do not have emotions and desires, but we have a natural animism (an intention ascriptor) to parallel our tendency to see faces where none exist (pareidolia). More recent versions of the Heider-Simmer illusion are seen in social animation tasks used to understand mindreading (29).

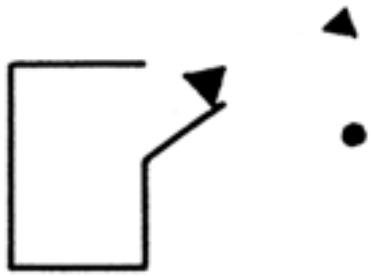

Figure 5. A frame of the Heider-Simmel animated videoclip.

Presumably, in the manner of the smoke-detector principle, in the past it was more important to see faces and intentions (even if none existed) than to miss the ones that were present. From animism to sophisticated theologies, most humans have a deep-seated belief that things like the universe itself can have intentions and desires in relation to us. Interestingly, those on the autistic spectrum are both less likely to believe in God (65) and are less subject to pareidolic illusions (66). Being more oriented to systematising than empathising appears to lessen the strength of this pervasive illusion (67).

4.5. Movie for the Assessment of Social Cognition

The Movie for the Assessment of Social Cognition (MASC) (68) features four realistic characters at a dinner party, who display stable traits and transient states. The relevant themes are romance and friendship, and questions about the characters’ cognitive and affective mental states require the participants to interpret physical, vocal, and contextual information, as well as to understand false beliefs and metaphors (Figure 6).

Picture 1 Cliff is the first one to arrive at Sandra's house for the dinner party. He and Sandra seem to enjoy themselves when Cliff is telling about his vacation in Sweden (Printed with permission)

Picture 2 When Michael arrives, he dominates the conversation, directing his speech to Sandra alone (Printed with permission)

Figure 6. Frames from the Movie for the Assessment of Social Cognition.

6. Mindreading in altruism

Prosocial behaviors result from a wide variety of factors that, at first glance, seem to be polar opposites: intention or intuition, nature (instinct) or nurture (learned), value inferred from actions and their outcomes, and altruism or egoism (69). It is important to distinguish the proximate motivations for altruism (such as empathy or concern for others) from the biological puzzle of how altruism (in its strict Hamiltonian sense) could evolve in the first place. Hamilton (70) solved the latter puzzle regarding inclusive fitness –an axiomatic extension of Darwinian fitness to explain how sentiments and behaviors favorable to conspecifics but at the expense of the actor could evolve in the first place. However, the (ultimate) explanation is not what people typically mean when they use the term "altruism". What is meant is usually a collection of positive pro-social impulses towards others that may cost something to the actor, but often result in the mutual benefit of some kind.

The altruistic motivation underlying prosocial behavior requires explanation, since there are high costs involved in helping others, no matter whether empatically or egoistically motivated or both (i.e., feeling better about oneself for helping others, avoiding punishment, gaining rewards), though neither mindreading nor empathy are prerequisites for prosocial behaviour (71). The genetic (ultimate) basis for altruism is discussed in terms of kin and group selection (72), inclusive fitness (70), and reciprocal altruism (73) theories. However, Empathy-Altruism Theory addresses the proximate relevance of such mechanisms for social cognition. The theory posits that the ability to show empathic concern underpins the altruistic motivation needed to reduce the suffering of others. In other words, the behavior of altruists seems to be modulated by their ability to empathise with others. Furthermore, high levels of cooperation require high-level mindreading and empathic abilities, which would have favoured altruistic behaviour in our ancestors (71).

It is widely accepted that superior mindreading abilities facilitate group cooperation by modulating the level of understanding between team members. For example, de Vignemont and Singer (74) suggest a dual role for empathy; to allow the gathering of contextual information about the future actions of others, as well as to support prosocial behaviors, cooperation, and effective social communication. The link between prosocial learning and empathy was also investigated with fMRI and revealed (not surprisingly) that individuals learned to obtain rewards for themselves faster than for others, and that the

variability in prosocial learning could be modelled by trait empathy: people with higher empathy learned more quickly when benefitting others than people with lower empathy (75). Interestingly, an increased activity observed in the right pSTC during action perception, compared with action performance, was shown to be predictive of higher self-reported altruism (76).

According to Tomasello (77), socialization via a shared culture can modulate altruism; the puzzling mixture of unselective altruism and selfish sharing behaviour observed in young children is slowly replaced during development by a more discerning and targeted type of altruism. This trend was attested in a study where children as young as three years old showed a more frequent sharing behaviour towards other children in their group who had been nicer to them in the past (78). Later on, children start discerning intentionality in others by observing the direction of people's gaze and by inferring their knowledge of a given situation based on their own past actions and observations (79), which is usually referred to as "shared intentionality" (77), which in turn relies on one's mindreading ability.

Research on the nature of the interplay between mindreading and social behaviours such shared intentionality, altruism, and general morality in typical adults with different cultural backgrounds is still in its infancy. One should bear in mind that mindreading *per se* has no internal moral compass, as reflected in the behaviour of both altruists and psychopaths. Since mindreading can also be employed to exploit, deceive or entertain others, behaviors such as Machiavellism, psychopathy, narcissism, and even performances by "magicians", which are considered below.

7. Mindreading in psychopathy (and other "dark personalities")

Psychopathy is part of the so-called "dark triad of personality", which also includes narcissism and Machiavellianism. There is no clear-cut behavioural distinction between the "Dark Triad" personalities. To varying degrees, the elements of the triad share malevolent characteristics, which are evidenced in the propensity toward deception, self-promotion, emotional coldness, low agreeableness, and aggressiveness (80, 81).

7.1. Psychopaths

A psychopathic personality disorder (or psychopathy) is characterized by emotional detachment and assorted antisocial traits, alongside strong associations with criminal behavior and reoffending (82, 83). Psychopaths are often called sociopaths, and the terms have been used interchangeably. Some psychopathic behaviors are evidently criminal (i.e., murder, rape, recidivism), but there is some confusion (if not an outright contradiction) in the specification of core psychopathic behaviors; for some, psychopaths are cold-blooded and have strong self-control; for others, they are impulsive and thrill-seeking. Some are described as aggressive and very successful professionally (e.g., some CEOs are believed to have high psychopathic traits), while others are described as being emotionally superficial and reckless, but most scholars agree that psychopathic behavior is mean, bold, and lacking in moral inhibition (84, 85). Unlike altruists, psychopaths show poor empathic-concern. Comparable to conmen and torturers, psychopaths also need to have well-developed mindreading ability (even if only cognitive mindreading skills such as inferring others' intentions and beliefs) to be able to fool and exploit others as effectively as they often do (86).

Mindreading studies on individuals with high psychopathic traits revealed patterns of brain activation similar to the ones observed in altruists, even though a study employing *in vivo* diffusion tensor magnetic resonance imaging tractography showed abnormalities in an

amygdala-orbitofrontal cortex network linked to psychopathy (87). Nonetheless, the processes involved in mindreading in both altruists and psychopaths were cognitively demanding and required the use of a wide range of complex and traditional executive functions, including decision-making, planning, response and conflict monitoring, working memory, and attention (51, 88, 89). Perhaps psychopaths are good at attributing exploitative motives to others, but poor at recognising that others may do the same to them? This would explain the characteristic outrage and surprise when people of this disposition are caught out (83).

7.2. Machiavellians and narcissists

Machiavellians are seen as people with utilitarian morals who are manipulative, cynical, dominant, secretive, and suspicious (90, 91). They think in both concrete and pragmatic terms and tend to be emotionally unstable and anxious about relationships (12). Machiavellians routinely assume that they will be exploited by others, to whom they attribute negative intentions and unwillingness to cooperate (92). They also show decreased motivation regarding "affective" mindreading or "hot" empathy (93), and a negative correlation between Machiavellianism level and affective face recognition was observed (94, 95). Although Machiavellians seem to be able to infer the thoughts and intentions of other people, they fail to grasp emotional states such as guilt, shame or sympathy and lack the motivation to feel what others are feeling (12, 95). A narcissistic personality disorder shares many of the features observed in psychopaths and Machiavellians, but it is dominated by a heightened sense of self-worth and superiority, a propensity to self-deception, and a link with antisocial behaviour (96).

7.3. Con-artists and magicians

Con-artists are different again, although they have considerable overlap with Machiavellian personality types. They rely on the fact that most people, most of the time, do not regularly lie about certain sorts of events. In other words, we normally assume that we can make reasonable predictions about intentions and the con-artists can only survive using frequency-dependent selection: if enough people were untrustworthy, then working on confidence would no longer work because confidence in general would have broken down. It is said that it is impossible to con an honest man. This is untrue. However, it is impossible to con someone without their attributing malicious intentions to us.

While not Machiavellians in the true sense, magicians (especially those who claim genuine abilities) do exhibit traits that shed remarkable light on the complexity of intention reading in humans. For magicians, the term "mindreading" has a somewhat different (albeit overlapping) meaning compared to the definition used by psychologists and neuroscientists. In the context of a magic show mindreading equates to a series of displays of the apparently impossible, such as plucking thoughts from a person's mind, or seeing what they have written and sealed in an envelope. Modern stage magicians can be sharply divided over the ethics of performing mind-reading effects on stage (as opposed to other forms of conjuring) and how these should be presented. There is a good reason for this, namely, that lay audiences are inclined to believe that what they are witnessing is real. This belief can be (and has been) exploited by the unscrupulous to pretend that they can read the intentions (the minds) of potential lovers and lost children, for example.

By contrast with other forms of magical performance, audiences do not typically seriously entertain the hypothesis that the performer has actual powers. There are exceptions

to this (for example, the spoon-bending of Uri Geller). Yet, a typical audience member does not believe that David Copperfield can fly (one hopes), but that he or she is watching a surprising and mystifying illusion. All the stage psychic is doing is pushing at the bounds of a belief that already has some very porous edges. As mentioned above, one key contrast is the mutual social construction of shared reality that occurs in psychic performances of mind-reading but not with other forms of magical performance. One way to see this contrast is to appreciate that a non-human animal can be brought to respond with surprise and attention to some forms of prestidigitation. Presumably, this is because their theory of the continued existence of unseen objects is something they share with us (Piaget, 1972). However, there is no equivalent of surprising a dog with a mind-reading trick. "Revealing the card (or treat) they were thinking of" has no meaning to a dog because our shared reality does not involve this level of mind-reading. Other primates seem to show an attenuated sense of being able to fool others or showing expectations of being fooled (97).

8. Final considerations

This chapter addressed conceptual and methodological aspects of mindreading, which is a highly flexible human ability since vicarious responses are (more often than not) successfully adapted to a wide range of contexts. The mindreading toolkit encompasses a complex range of behaviors such as altruism, empathy/psychopathy, and cognitive abilities from more general domains, which are rooted in cognitive and affective processes evolved to facilitate social interactions. As suggested by many researchers, more studies are needed to elucidate the underpinnings of mindreading in neurotypical adults during assorted social exchanges (which includes verbal communication). Furthermore, the understanding of the extent to which mindreading is modulated by culture is of utmost relevance for science and society.

List of abbreviations

(by order of appearance in the text)

TT: Theory Theory
ST: Simulation Theory
PFC: prefrontal cortex
STS: superior temporal sulcus
TC: temporal cortex
pSTS: posterior STS
dMPFC: dorsomedial prefrontal cortex
vMPFC: ventromedial prefrontal cortex
TP: temporal pole
TPJ: temporoparietal junction
PCC: precuneus cingulate
AI: anterior insula
mACC: middle anterior cingulate cortex
RMET: Reading-the-Mind-in-the-Eyes Test
ASD: autism spectrum disorder
FBT: false belief task
MASC: Movie for the Assessment of Social Cognition

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