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Children understand subjective (undesirable) desires before they understand subjective (false) beliefs

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ABSTRACT

Our folk psychology is built around the ascription of beliefs (and related cognitive states) and desires (and related conative states). How and when children develop a concept of these different kinds of propositional attitudes has been the subject of a long-standing debate. Asymmetry accounts assume that children develop a conception of desires earlier than they develop a concept of beliefs. In contrast, the symmetry account assumes that conceptions of both kinds of attitudes are based on the same underlying capacity to ascribe subjective perspectives. Accordingly, a genuine subjective understanding of desires develops in tandem with subjective belief understanding. So far, existing evidence that tested these two accounts remains inconclusive, with inconsistent findings resulting from diverging methods. Therefore, the current study tested between the two accounts in a more systematic way. First, we used a particularly clear test case—value-incompatible (wicked) desires. Such desires are strongly subjective because they are desirable only from the agent's perspective but not from an objective perspective. Second, we probed children's ascription of such desires in the most direct and simplified ways. Third, we directly compared children's desire understanding with their ascription of subjective beliefs. Results revealed that young children were better in reasoning about subjective desires than about subjective beliefs. Desire reasoning was not correlated with subjective belief reasoning, and children did not have more difficulties in reasoning about strongly subjective wicked desires than about

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neutral desires. All in all, these findings are not in line with the predictions of the symmetry account but speak in favor of the asymmetry account.

Introduction

Rational action is based on practical reasoning. Practical reasoning, from the first-person perspective, proceeds from evaluative premises (e.g., "more oxygen in the room would be good") and factive premises (e.g., "opening the window will let in more oxygen") to intentions ("I will open the window") and finally to actions ("opening the window"). From the third-person perspective, explaining the rational action of another agent proceeds, in a reverse inference, by reconstructing the practical reasons underlying a person's action: "Why did she open the window?"; "Because she wanted to let in more oxygen and thought that opening the window was a means to do so." Thus, actions are explained by ascribing two kinds of underlying subjective attitudes that jointly rationalize them: conative attitudes such as desires (e.g., "... more oxygen") and cognitive attitudes such as beliefs (e.g., "opening the window will bring in more oxygen"). For this reason, our folk psychology (or theory of mind) is at its core a "belief–desire psychology" (Fodor, 1975).

From an ontogenetic perspective, one of the central questions of theory of mind research is how belief–desire psychology develops. One particular question concerns the acquisition of concepts of desires and concepts of beliefs relative to each other. There are two broad competing views. The asymmetry view assumes that an understanding of subjective desires develops before an understanding of beliefs (e.g., Rakoczy, Warneken, & Tomasello, 2007; Steglich-Petersen & Michael, 2015; Wellman & Woolley, 1990). In contrast, the symmetry view assumes that the understanding of subjective desires and the understanding of subjective beliefs develop in close tandem because they are based on the very same underlying cognitive capacity (Perner, Priewasser, & Roessler, 2018; Perner & Roessler, 2010) (see Table 1 for an overview). So, what is the reasoning behind these bold claims? From the perspective of the asymmetry account, there are two plausible, not necessarily mutually exclusive, reasons why an understanding of subjective desires might develop before an understanding of subjective beliefs. First, the desire–belief asymmetry may be due to asymmetries in explanatory practice. If I were asked to explicitly state a psychological explanation for a person opening the window, I would most likely just answer, "Because she wanted to let in more oxygen." Strictly speaking, such forms of rational action explanation are elliptical because they omit the premise regarding the agent's belief. But because in most cases we can easily take the content of the other agent's beliefs (opening a window lets in oxygen) as factual common ground, this elliptical form is usually perfectly fine. Thus, desires have a certain primacy in terms of explanatory power (Steglich-Petersen & Michael, 2015). Ontogenetically, this primacy of desire ascription in terms of explanatory power and frequency may lead to a primacy in acquisition such that children come to ascribe desires earlier and more readily relative to beliefs (Rakoczy et al., 2007).

Second, the desire–belief asymmetry may be due to differences in the logical structure of beliefs versus desires. Desires have what is often called a "world-to-mind direction of fit"; they aim at adjusting the world (lack of oxygen) according to the propositional content of the desire (more oxygen). In contrast, beliefs have a "mind-to-world direction of fit"; they aim at representing the world accurately by bringing the representational content of beliefs in line with the world (Searle, 1983). This difference in logical structure comes with different normative implications. Beliefs, in contrast to desires, aim at truth and thus are evaluated against the normative standard of being accurate, and their default is being true (unless we ascribed mostly true beliefs, belief ascription could never get off the ground). Thus, belief attribution requires the interpreter to coordinate the ascription of belief contents with the true states of affairs in a way not required for desire ascription and, in the case of false beliefs,

Table 1
Overview of asymmetry and symmetry accounts.

	Asymmetry account	Symmetry account
Theory	Children develop a subjective understanding of desires *before* they develop a subjective understanding of beliefs.	Children develop a conception of subjective perspective around 4 years of age. This shared core competence allows them to reason subjectively about desires and beliefs. Before this, children only engage in objective teleological reasoning.
General predictions	Children can reason about an agent's subjective desires before they can reason about beliefs.	Children can reason about an agent's subjective desires at the same age when they can also reason about beliefs. Both capacities are related.
Study-specific predictions	Young children are better at reproducing neutral desires and wicked desires than at solving the standard false belief task.	Young children are better at reproducing neutral desires than at reproducing wicked desires and solving the standard false belief task. Reasoning about wicked desires and reasoning about false beliefs are strongly related.

to inhibit the default ascription of true beliefs. This makes belief ascription more demanding in terms of inhibition and executive function more generally (Rakoczy, 2010).

In contrast, the symmetry view builds on the assumption that a genuine understanding of both desires and beliefs requires the very same conceptual capacity to understand subjective attitudes and perspectives (Perner & Roessler, 2012). Accordingly, a proper understanding of desires and beliefs will develop in tandem around 4 years of age. Earlier in development, children do engage in rational action explanation of sorts. But this is restricted to a teleological form of reasoning based on objective facts and values or goals (rather than on subjective beliefs and desires): "Why did she open the window?"; "Because more oxygen was needed in the room, and opening the window let in more oxygen." Thus, young children understand that agents act toward certain ends (more oxygen in the room) and that certain means are appropriate to reach these ends (open windows → more oxygen) (Perner & Esken, 2015; Perner et al., 2018; Perner & Roessler, 2010). But nothing in this explanatory scheme requires the interpreter to take the agent's subjective perspective (for related proposals, see Apperly & Butterfill, 2009; Flavell, 1988; Gergely & Csibra, 2003; Gordon, 1986). Even though it does not involve any ascription of subjective perspectival attitudes, this teleological reasoning schema is quite powerful; it allows children (and arguably adults in many circumstances) to predict and explain many kinds of actions.

From a theoretical perspective, both kinds of accounts thus provide reasons for why an understanding of desires should develop before (asymmetry) or in tandem with (symmetry) belief reasoning. But what about the empirical situation? In what follows, we explain why it is not trivial to test both accounts against each other, introduce three testing approaches that attempt to do so, and review their evidence and limitations.

At first glance, testing asymmetry and symmetry accounts against each other appears to be an easy task. Just ask children to ascribe desires and beliefs and see what is achieved first. And indeed, a large body of empirical work has followed this approach. What researchers have found clearly prima facie seems to support asymmetry accounts. Long before children can reason about beliefs, they proficiently handle desires (Wellman & Liu, 2004). They predict that agents will cease to perform an action once their desire is fulfilled (Wellman & Wooley, 1990), and they ascribe positive emotions to agents who have fulfilled their desires and negative emotions to agents who have not (Hadwin & Perner, 1991; Wellman & Banerjee, 1991). Yet on closer inspection, these results turn out to be perfectly compatible with the symmetry teleological account as well. The tasks do not require a subjective genuine under-

standing of desires but rather can be solved by the restricted teleological form of reasoning. Based on objective facts and goals, one can predict that someone will perform the action that is the means to achieve a certain objectively desirable end and will cease that action once this end is achieved. Likewise, objective reasoning suffices to make the connections "achieve desirable end → positive emotions" and "not achieve desirable end → negative emotions". Teleological reasoning even allows a young teleologist to predict and understand actions based on person-relative goals such as the following one from a famous study (Repacholi & Gopnik, 1997). Children can predict that, when faced with a choice of broccoli or crackers, different agents may make different choices; an adult may make the absurd choice of broccoli (from the child's perspective), whereas another child will choose the cracker. To do this, one need not revert to subjective desires; rather, an understanding that different things are desirable for different agents is sufficient; broccoli is good for adults, whereas crackers are good for children (compare: rotten meat is good for hyenas but not for humans).

How then can we empirically decide between asymmetry and symmetry accounts more stringently? Crucially, the accounts make competing predictions with regard to understanding desires that stringently require subjective reasoning. According to the symmetry account, these strongly subjective desires require the same subjective reasoning capacities as mis-representations of reality (false beliefs). Teleological reasoning cannot make sense of either of them. Accordingly, the teleological account predicts that an understanding of such subjective desires should develop in tandem with an understanding of false beliefs. In contrast, the asymmetry account predicts that even strongly subjective desires should be understood and ascribed before beliefs.

Strongly subjective desires in this sense involve some incompatibility between the subjective content of the desire and something else. This can come about in different ways. One such way (which is not the focus here) is that several desires may be mutually incompatible within one agent (intrapersonally conflicting; e.g., losing weight vs. eating this cookie) (Choe, Keil, & Bloom, 2005).

A second way in which desires can be incompatible is when desires of two agents are mutually exclusive (interpersonally conflicting). For instance, A wants to win the race (p), but B also wants to win the race (q). p and q are mutually incompatible. The moment one agent wins the race, the other agent cannot win the race anymore. This cannot be framed in terms of person-relative desirability. Both A and B have a certain attitude toward p. These attitudes are in direct conflict. Thus, to reason about A's and B's desires and predict their actions and reactions, one needs to relativize to A's and B's subjective standpoints; p is good from A's point of view but is bad from B's point of view.

A third way pertains to desires that are incompatible with objective values and norms such as wicked desires. To understand such desires, one needs to relativize what is seen as good or bad from the agent's subjective standpoint. Suppose A wants to hurt B. Then the outcome "B is suffering" will be objectively bad but will be good from A's wicked perspective. Like in the case of mutually incompatible desires, an interpreter can make sense of such a situation only by reverting and relativizing to A's subjective perspective—objectively bad but subjectively good from A's standpoint.

Thus, there are different ways to tap a subjective understanding of desire and to test between asymmetry and symmetry accounts. Existing research has mainly focused on interpersonally incompatible desires. Yet, the evidence from this line of research so far is mixed and hard to interpret (for an overview of the accounts' predictions, see Table 1). Some studies found that children can reason about such incompatible desires earlier than they can reason about beliefs (e.g., Fizke, Barthel, Peters, & Rakoczy, 2014; Proft, Hoss, Paredes, & Rakoczy, 2021; Rakoczy, 2010; Rakoczy et al., 2007). Other studies found that children develop this ability only later—when they can also reason about beliefs (e.g., Lichtermann, 1991; Moore et al., 1995; Priewasser, Roessler, & Perner, 2013). These inconsistencies in findings might stem from substantial underlying conceptual and methodological disagreements.

Conceptually, there is disagreement regarding the question of which types of situation require a genuine understanding of subjective perspectives. Some studies confront children with desires that are incompatible in the sense that if A's desire is fulfilled, B's cannot be fulfilled anymore (e.g., Lichtermann, 1991; Rakoczy et al., 2007). Yet, it has been argued that, strictly, only those cases where fulfilling A's desire also entails obvious negative consequences for B (like in competitive game contexts) require subjective reasoning (Perner & Roessler, 2010; Priewasser et al., 2013).

On a methodological level, it is not clear what types of tasks are appropriate implementations of such situations. One such implementation is to ask whether children ascribe the respective emotions

to A and B. Initial studies showed poor performance before 4 years of age (Lichtermann, 1991), but once the questions were simplified and suitably introduced in subsequent research, 3-year-olds performed competently in most cases (Rakoczy et al., 2007). Other studies implement incompatible desires by engaging children in competitive games with other agents. Again, initial studies found young children to struggle to ascribe their opponents' incompatible desires (Moore et al., 1995) and to act in a way that would fulfill their own desires while hindering the opponents from fulfilling their desires (Priewasser et al., 2013). But also in this implementation, children had no difficulties in reasoning about their opponents' conflicting desires if the inferential complexity was reduced or children were not required to harm their opponents but only needed to report the incompatible desires (Proft et al., 2021; Rakoczy et al., 2007). Accordingly, these conceptual and methodological disagreements make it difficult to draw conclusions from evidence building on interpersonally incompatible desires.

In contrast, more conceptual clarity and agreement hold in the case of desires that conflict with values and norms. In existing studies on children's understanding of wicked desires, participants were asked to rate an agent's emotion after her wicked desire (e.g., pushing someone off a swing) was fulfilled. The typical developmental pattern found was that until 4 years of age, children ascribe negative emotions to this agent although her desire was fulfilled, and only from 4 years onward do children then ascribe positive emotions ("she is happy because she succeeded in pushing the other child off") (Yuill, 1984; Yuill, Perner, Pearson, Peerbhoy, & Ende, 1996). On a conceptual level, this fits nicely with the prediction of the symmetry account; "pushing someone off the swing for no reason" is objectively not desirable and is incompatible with norms (in this case moral ones) and values. Thus, ascribing a desire with such content requires relativization to the agent's subjective standpoint (as such it is bad, but from the agent's perspective it is good).

So, prima facie, the evidence from children's development of understanding wicked desires speaks for the symmetry account (see Table 1). However, taken by themselves, these findings are difficult to interpret for at least two methodological reasons. First, ascribing attitude-dependent emotions adds an extra layer of complexity. Inferentially, it goes a crucial step beyond the mere ascription of the state in questions (here desires)—ascribe the attitude in question, relate it to reality, and infer the emotion on the basis of the (non-)fulfillment of the attitude (desire fulfilled → happy; desire unfulfilled → sad/belief fulfilled → not surprised; belief not fulfilled → surprised). Correspondingly, the ability to ascribe mental state-dependent emotions (happiness/surprise) has been found to develop with a delay relative to the ability to ascribe the mental state itself (desire/belief) (Hadwin & Perner, 1991; Harris, Johnson, Hutton, Andrews, & Cooke, 1989). Taking the ascription of an attitude-dependent emotion as an indicator of understanding the attitude in question thus may underestimate children's competence.

Second, the evidence so far does not show directly that ascribing desire-dependent emotions in the case of wicked desires is based on the same type of general subjective reasoning that also underlies subjective belief ascription (see Table 1). Existing studies found similar ages of onset in the two types of capacities (ascribing emotions based on wicked desires and ascribing false beliefs). Yet, similar ages of onset are not sufficient to show shared underlying competencies. Accordingly, regarding value-incompatible desires, there is conceptual clarity, but existing evidence still falls short of methodological clarity. What is missing is more direct evidence that the two types of competencies, understanding wicked desires and subjective reasoning about beliefs, go together (i.e., correlate).

Against this background, the rationale of the current study was to test between the symmetry and asymmetry accounts in systematic and novel ways. Both accounts make very clear and competing predictions, and the current study tested them against each other. To this end, we used value-incompatible desires as a test case and capitalized on the memory-for-complements task as an indicator of mental state ascription, thereby avoiding problems of previous studies that used emotion ascription. To our knowledge, the current study is the first to use this direct measure for value-incompatible desire and to draw direct comparisons with subjective belief reasoning capacities. Conceptually, these cases are clear: Value-incompatible desires are strongly subjective and cannot be grasped on a restricted teleological level. Methodologically, we sought to implement more stringent investigations of children's understanding of such cases than previous studies and directly compared children's understanding of wicked desires with neutral desires and their ability to ascribe false

beliefs. The logic here was as follows (see also Table 1). The symmetry account predicts that children who cannot ascribe false beliefs should also fail to ascribe subjective wicked desires, but they should have no difficulty in ascribing neutral desires (which fall within the scope of simple objective teleological reasoning). In contrast, the asymmetry account predicts that children should be able to ascribe all desires, neutral as well as wicked ones, before they can ascribe false beliefs.

Against the background of the methodological limitations of existing studies, we employed a direct measure of children's desire understanding (rather than an indirect one based on desire-dependent emotion ascription) and compared it with children's false belief understanding directly (rather than relying on indirect comparisons of age of onset).

As a direct measure of children's understanding of desires, we capitalized on so-called memory-for-complements tasks. These were originally applied in the research on children's understanding of cognitive attitudes such as beliefs. The logic of this task is as follows. Children see a picture of two agents (e.g., Protagonist A sees B doing something behind a pile of books). They are told about A's belief in the format "She believes *that* X" (She believes that A reads a book). Then, children are told that this belief is false—"But Y is the case" (But B is playing cards)—and see a picture of the reality. The test question then asks children to reproduce the sentential complement (*that* X) of the agent's initial belief ("What did she believe?"). Children fail this seemingly easy task until 4 years of age, and performance in this task strongly correlates with traditional belief ascription tasks such as the false belief task (De Villiers & Pyers, 2002). This makes memory-for-complements tasks a convenient and direct measure for tapping children's understanding of the concept of those mental states that can be expressed via "that" complements. In contrast to English, in German this is also the case for desires. Perner, Sprung, Zauner, and Haider (2003) already made use of this in a very elegant design to directly compare children's understanding of desires and their understanding of beliefs. They found that children can reproduce that complements of neutral desires around the same age as they can ascribe these in other tasks, and thus they do so before they reproduce "belief that" complements and ascribe beliefs more generally.[2] Yet, because that study was mainly interested in linguistic components, the ascription of desires in the study was restricted to neutral desires and thus did not require subjective reasoning. In the current study, we built on this direct measure of desire understanding and extended it to study children's understanding of value-incompatible desires.

We implemented these approaches in the following way. We directly compared children's understanding of value-incompatible wicked desires with their understanding of neutral desires that can be made sense of with an objective teleological notion of desirability, and we related both to children's ascription of subjective beliefs in a standard false belief task (Wimmer & Perner, 1983). In memory-for-complements tasks, children observed a puppet who expressed desires regarding what a monkey ("Monkey") should do. These could be either wicked (e.g., Monkey should destroy someone else's painting) or neutral (e.g., Monkey should hang the necklace on the stand). Monkey never fulfilled these desires but performed alternative actions (e.g., put the painting on the shelf and put the necklace in a box). Children were then asked what the puppet wanted Monkey to do (in the German "want + that" complementation construction). These scenarios followed the logic of Perner and colleagues' (2003) second study, where they used acted-out versions that made the scenarios more vivid, more concrete, and easier to follow.[3] The asymmetry account would be supported by the following pattern: Children can reproduce neutral and wicked desires even before they solve the standard false belief task.

[2] Theoretically, it is possible that the way in which desires are phrased in a certain language influences the development of children's concept of desires. However, empirically, no such influence of German versus English syntax has been found for desires (or for any other states for that matter). The developmental trajectories of various forms of theory of mind, including desire ascription, have been found to be very similar in English- and German-speaking children (Kristen, Thoermer, Hofer, Aschersleben, & Sodian, 2006; Wellman & Liu, 2004).

[3] To validate our adaptation of the memory-for-complements task, we conducted a pilot validation study. In this study, children received memory-for-complements tasks that were similar in design and structure to our main desire task. But instead of desire complements, children reproduced belief complements and—as an external validation—we directly compared performance in this task with performance in a standard false belief task. Results revealed that the two types of measures were strongly correlated. Thus, the memory-for-belief-complements task taps into the same capacity as the standard false belief task. More generally, just like original memory-for-complements tasks, our adaption appears to be a valid measure of children's understanding of mental states (see online supplementary material for a detailed description of method and results).

In contrast, the symmetry account would be supported by this pattern: Children can reproduce wicked desires only when they also solve the false belief task. Neutral desires can be reproduced even earlier.

Method

Participants

A total of 61 2½- to 4-year-old monolingual German children (31–58 months of age; M_{age} = 41.8 months; 30 girls) were included in the final sample. An additional 3 children were tested but excluded from data analyses because they were uncooperative (n = 2) or did not fulfill the language requirements (n = 1). This age range was similar to that in the original studies by Perner and colleagues (2003; Experiment 1: 3.6–4.8 years; Experiment 2: 2.5–4.5 years) and allowed the inclusion of children who had and had not yet developed an explicit false belief understanding. For the main comparison of interest, younger children's performance on wicked desires and false beliefs, this resulted in a test power of $1 - \beta$ = 1.000 (obtained via G*Power Version 3.1). Participants were recruited from a databank of children whose parents had previously given consent to experimental participation. The testing was conducted in single sessions by two female experimenters (E1 and E2) in the laboratory.

Design

In the desire task, each child was tested in two conditions: complementation of neutral desires and complementation of wicked desires. The conditions consisted of two trials each (two neutral desires and two wicked desires), resulting in a total of four trials for the desire task. The order of the trials was counterbalanced (24 orders of presentation). Before the four experimental trials of the desire task started, children received a two-step warm-up phase. In addition, children received two trials of a standard false belief task. One half of the children received the false belief task before the desire task, and the other half received it after the desire task. The whole test session lasted about 20 to 25 min.

Materials and procedure

Desire task

The overarching theme of the desire task was a hand puppet theater with a boy called "Tom," Monkey, and a frog ("Frog") acted out by E2. Tom was introduced to the children in the beginning of the test session. Monkey and Frog joined the scene in the beginning of the experimental trials.

Warm-up phase

In the first step of the warm-up phase, children were acquainted with commenting on Tom's actions (e.g., pulling a stone out of his trousers' pockets). In the second step, children needed to verbalize actions displayed by a woman in a short video (e.g., putting a toy drum in a box). This ensured that all participants were able to verbalize the relevant actions for the desire task (for details, see online supplementary material).

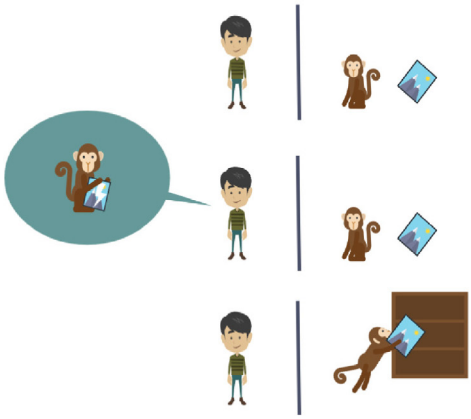
Experimental trials

For the experimental trials, Tom and Monkey were placed on two sides of an occluder so that they could not see each other. The child sat in front of the scene so that he or she was able to see both Tom and Monkey. E1 made sure that the child understood that Tom and Monkey were not able to see each other because of the occluder.[4] Frog joined the scene and gave E1 and the child a box containing some of

[4] This was parallel to Perner and colleagues' (2003) study and was necessary for two reasons. First, this avoided that children interpreted Monkey's alternative action as provoking disobedient behavior toward Tom. This was important to not generate an additional dimension of valence in this task. Second, if Tom had seen that Monkey did not perform the desired action, he should have protested. The lack of such protest could then be interpreted as a change of desire.

his beloved self-made belongings. Frog then needed to leave again and left the box with E1 and the child. Afterwards, the four experimental trials of the following scene began.

E1 took one of the objects out of Frog's box and put it in front of Tom and Monkey on the table (e.g., a painting or a self-made necklace). Tom then stated his desire to the child. The desire—neutral or wicked—was always about Monkey conducting an action with the object (e.g., wicked desire: "Monkey should tear the painting"; neutral desire: "Monkey should hang the necklace on the stand"). Tom did not directly state what he wanted Monkey to do but only what he should do to make the task as parallel as possible to the desire condition of the complementation task by Perner and colleagues (2003). Consequently, children needed to infer the desire from Tom's utterance. This also ensured that the desire stayed unfulfilled and avoided potential complications in cases where Tom himself could have brought about the desired state of affairs (if this was the case but Tom did not act, the child might wonder whether Tom truly still had the desire in question or whether he had rather changed his mind). All desires shared by the boy were spoken in a friendly voice. There was no difference in pitch and expression between the neutral and wicked desire trials. The objects necessary to conduct the desired action (e.g., the stand on which to hang the necklace) were available in the scenery of each trial. However, Monkey always conducted an alternative neutral action with the object (e.g., Monkey put the painting on the shelf). Because Tom was on the other side of the occluder, he could neither see Monkey performing the action nor see the outcome of the action. After Monkey performed the action, E1 asked the test question about Tom's desire ("What did Tom want Monkey to do with the painting?") and the control question about Monkey's actual action ("What did Monkey actually do with the painting?") (see Fig. 1 for example procedure). The direct translation of the test question in Ger-



1. Tom and Monkey are separated by an occluder. Child can see both Tom and Monkey. E1 puts the Frog's self-made painting on the table. Child, Tom and Monkey can see it.
2. Tom to the child: "The monkey should tear the painting."
3. Monkey puts the painting carefully on a shelf. Child, but not Tom can see Monkey's action.
4. Test question: "What did Tom want Monkey to do with the painting?"[4]
5. Control question "What did Monkey actually do with the painting?"

Fig. 1. Example procedure: Memory-for-complements trial with wicked desire.

man language includes a that complementation ("What wanted Tom that Monkey does with the painting?"). If the child did not answer, E1 gave the child the first part of the sentence to answer ("Tom wanted that Monkey . . ."). E1 pretended to ask the test and control questions as real information questions (questions asked in order to receive new information) and not as academic test questions (questions asked not to receive new information but rather to test whether the interlocutor knows the answer). Research has shown that academic test questions are difficult to understand for children (Siegal, 1999). To make her question appear as natural and real as possible, E1 asked it in the following way. She turned her back on the scene while Tom uttered his desire and Monkey performed the action. After the control question, E1 took another object out of Frog's box and the next trial began.

False belief task

Children received two trials of the standard change-of-location task with different stimuli (Wimmer & Perner, 1983) acted out by E1 with little plastic figures. Protagonist A (e.g., the boy) and his object (e.g., his ball) were presented to the child. Before leaving the scene, the boy placed his ball in one of two boxes (Box 1). In his absence, Protagonist B (e.g., the girl) moved the ball to the other box (Box 2) and the following control and test questions were asked:

- Control Question 1: In which box did the boy put his ball in the beginning? (correct answer: Box 1)
- Control Question 2: Where is the ball now? (correct answer: Box 2)
- Control Question 3: Who put it there? (correct answer: the girl)
- Test question: When the boy returns, where will he look for the ball first?" (correct answer: Box 1)

Children were corrected when they gave false answers to the control questions. The order and sides of the two trials in the false belief task were counterbalanced.

Results

Coding

Two observers coded all sessions from the videotape. An additional independent coder who was blind to the hypotheses coded a random sample of 25% of all sessions for reliability. The consistency of the ratings was high for all test questions in the desire and belief tasks (all Cohen's $\kappa s \geq .84$).

Desire task

In each trial, children received the test question that asked them to reproduce the desire's complement and a control question that asked them for the agent's actual action. When children answered this control question incorrectly, we excluded that trial from analyses (11.48% of trials). We scored the answer to the test question as correct when children reproduced the correct complement. In cases where children stated ignorance, gave the actual action, or gave random answers, we coded the answer as incorrect. This resulted in the binary outcome (correct–incorrect).

False belief task

Answers to the test question were scored as correct when children predicted that the protagonist would look for the object in the initial location. Based on children's score, we categorized children into two categories of false belief understanding. Children who answered two of two administered false belief test questions correctly were assumed to have a reliable understanding of beliefs and were classified as passers (n = 28). Children who failed to correctly answer one or both trials were classified as non-passers (n = 33).

Plan of analysis

The aim of this study was to test the asymmetry and symmetry accounts against each other. To do so, we tested the accounts' explicit predictions by applying two different approaches of analysis.

First, we looked at children's absolute performance as a function of mental state (neutral desire, wicked desire, or belief) and age because both accounts make very clear predictions regarding children's absolute performance. The asymmetry account predicts that younger children should be better in ascribing desires than in ascribing beliefs. The symmetry account makes a different but equally clear prediction that younger children should be better in ascribing neutral desires than in ascribing wicked desires as well as false beliefs.

Second, we took a relational approach. This allowed us to test how subjective reasoning (operationalized via belief reasoning) is related to wicked and neutral desire reasoning. Here, only the symmetry account makes a clear prediction: Performance in ascribing wicked desires should be strongly related with ascribing false beliefs.

Absolute performance

We compared children's absolute performance as a function of mental state (neutral desire, wicked desire, or false belief) (see Fig. 2) and age to test the asymmetric prediction (younger children perform better in ascribing desires than in ascribing beliefs) and the symmetric prediction (younger children perform better in ascribing desires than in ascribing beliefs).

To this end, we first divided our sample into younger and older children via median split (*Mdn* = 1251 days; 31 children $\leq$ median; 30 children > median). Performance in each task was operationalized as passing versus non-passing. We did this for two reasons. First, we had excluded from analyses trials in which children failed the control question. This makes sum scores incomparable. Second, we used different measures for desire reasoning and belief reasoning, which further reduces the informativeness of comparing sum or mean scores. For each mental state, passers were defined as children who succeeded in all available trials (i.e., non-excluded trials) for this state.[5] To test the prediction of the asymmetry account, we compared the numbers of passers in the desire and belief conditions. Table 2 shows how many children passed the desire tasks compared with the false belief tasks. In the younger age group, more children passed the desire tasks—neutral as well as wicked—than the false belief tasks. This was different for older children. There, more children passed the false belief tasks, aligning performance in the desire and belief tasks. This pattern was supported by separate one-sided McNemar's exact tests, which revealed that for younger children significantly more children passed the desire tasks than the belief tasks (neutral desires: odds ratio [*OR*] = 3.667, $p = .029$; wicked desires: *OR* = 16, $p < .001$). This was not the case for older children (neutral desires: *OR* = 0.333, $p = .965$; wicked desires: *OR* = 0.8, $p = .746$). Thus, as predicted by the asymmetry account, we observed children performing better in the desire tasks than in the belief tasks. In fact, children were even better in reproducing the subjective wicked desires than in reproducing the neutral desires. To test the prediction of the symmetriy account, we compared the numbers of passers in the neutral and wicked desire conditions. As can be seen in Table 3, results are opposite to the symmetric prediction: Younger children passed the wicked desire task more often than the neutral desire task. The same held for older children. Separate one-sided McNemar's exact tests support this pattern. For both age groups, we did not find that children pass the neutral desire task more often than they pass the wicked desire task (younger: *OR* = 1.25, $p = .998$; older: *OR* = 0, $p = 1$). Rather, the opposite was the case. A one-sided McNemar's test examining the reversed pattern found that significantly more of the younger children passed the wicked desire task than the neutral desire task (younger: *OR* = 8, $p = .012$). For older children, a McNemar's test in this direction could not be conducted

[5] For neutral desires, 10 children failed to answer the control question for one trial correctly. These children were counted as passers if they succeeded on the remaining trial. Two children failed control questions for both trials and therefore could not be included in comparisons regarding neutral desires at all. For wicked desires, 14 children failed on one control question and 1 child failed on both control questions. Note that for false beliefs, we followed the standard procedure. Children received control questions before test questions, and incorrect answers to control questions were corrected. Thus, no trials needed to be excluded from analyses for this state.

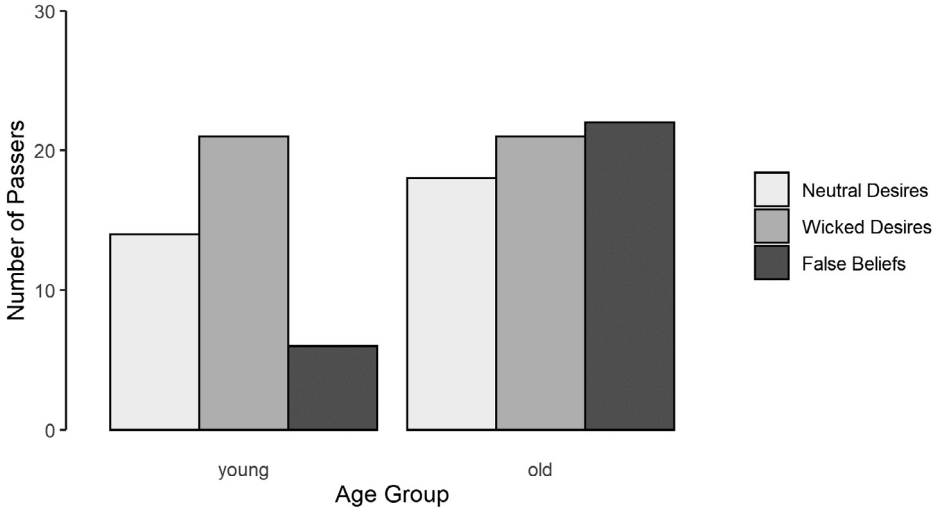


Fig. 2. Numbers of children passing all available trials by mental state for children younger and older than median age.

Table 2a
Contingencies of passing: Neutral Desires × False Beliefs.

			Neutral desires	
			Non-passers	Passers
False beliefs	Younger children (n = 30)	Non-passers	13	11
		Passers	3	3
	Older children (n = 29)	Non-passers	5	2
		Passers	6	16

Note. One younger child and one older child are not depicted here because they failed both control questions.

Table 2b
Contingencies of passing: Wicked Desires × False Beliefs.

			Wicked desires	
			Non-passers	Passers
False beliefs	Younger children (n = 31)	Non-passers	9	16
		Passers	1	5
	Older children (n = 29)	Non-passers	3	4
		Passers	5	17

Note. One older child is not depicted here because the child failed both control questions.

Table 3
Contingencies of passing: Wicked Desires × Neutral Desires.

			Neutral desires	
			Non-passers	Passers
Wicked desires	Younger children (n = 30)	Non-passers	8	1
		Passers	8	13
	Older children (n = 28)	Non-passers	8	0
		Passers	2	18

Note. One younger child and two older children are not depicted here because they failed both control questions.

because no older child failed the wicked desire task while passing the neutral desire task. Thus, we found the exact opposite of what the symmetry account predicted: Children actually performed better in the wicked desire task than in the neutral desire task.

Relational approach

We used a relational approach to test the prediction of the symmetry account that wicked desire and false belief reasoning share the same core competency (subjective reasoning) and accordingly should be strongly related. The symmetry account remains agnostic about the relation of false belief reasoning and neutral desire reasoning. It is possible, but not necessary, that there is a relation between these capacities caused by factors such as verbal demands. However, if there is any relation, this relation should be less pronounced because it should not be caused by a shared underlying competency. Overall, such a pattern would be reflected by an interaction of children's belief reasoning capacity and the desire's valence in the following way: There is a relation between false belief understanding and children's performance on the wicked desires task, but there is no relation or a less strong relation between false belief understanding and the neutral desires task.

We set up a generalized linear mixed model with binomial error structure and a logit link function (see supplementary material for a more detailed description of the model). We included the interaction of false belief understanding and valence of desires as a fixed effect. Age was included as a control variable. To account for repeated measures, we included children's ID as a random intercept effect. We checked for the model stability (see supplementary material) and multicollinearity (all variance inflation factors [*VIF*s] $\leq$ 1.526). To test for an overall effect of false belief understanding and valence of desires, we compared this full model with a null model that contained only the control variable, age, and the random intercept effect for children. This comparison revealed no significant effect (likelihood ratio test: χ^2 = 14.891, *df* = 3, *p* = .058).

What does this tell us? Children's performance depends to a substantial degree on their age and not on their belief reasoning capacity or the desire's valence (see also Fig. 3). With regard to existing doubts regarding the strict interpretation of *p* values and against the background that the obtained value exceeds the criterion of .05 to only a very slight degree, we took a closer look at the model. Yet, keep in mind that the overall model comparison did not reach significance. There was no interaction effect of false belief understanding and valence of desires (*b* = 0.309, *p* = .802, *OR* = 1.362) and no main effect of false belief understanding (*b* = 0.206, *p* = .908, *OR* = 1.229). Only the effects of valence of desires (*b* = 1.403, *p* = .046, *OR* = 4.067) and age (*b* = 2.343, *p* = .008, *OR* = 10.412) reached significance. Thus, even if the full–null model comparison was significant, there would be no evidence that belief reasoning is related to desire reasoning for either wicked or neutral desires[6]. We only found children to perform better with age. Moreover, children (possibly) are more likely to reproduce wicked desires than to reproduce neutral desires.

Discussion

The guiding question of the current study was how subjective conceptions of beliefs and desires develop in relation to each other. The symmetry account claims that a subjective understanding of desires develops before a subjective understanding of beliefs develops. The asymmetry account, in contrast, assumes that both concepts are acquired in tandem because they rely on a common core capacity to reason subjectively. Here, we tested these two accounts against each other in novel ways. First, we applied a more straightforward measure than earlier studies. Whereas earlier studies asked children to ascribe desire-dependent emotions, we asked children to directly reproduce sentential complements of value-incompatible (wicked) and value-compatible (neutral) desires. Second, we

[6] Separate regression analyses on aggregated mean scores of children's performance yielded similar results. Regression analyses revealed that belief reasoning was not related to wicked desire reasoning (*b* = 0.183, *p* = .129) or to neutral desire reasoning (*b* = 0.215, *p* = .087), especially when controlling for age (wicked desires: *b* = 0.041, *p* = .788; neutral desires: *b* = −0.001, *p* = .948). In contrast, there was a relation between wicked desire reasoning and neutral desire reasoning (*b* = 0.761, *p* < .001) even when controlling for age (*b* = 0.708, *p* < .001).

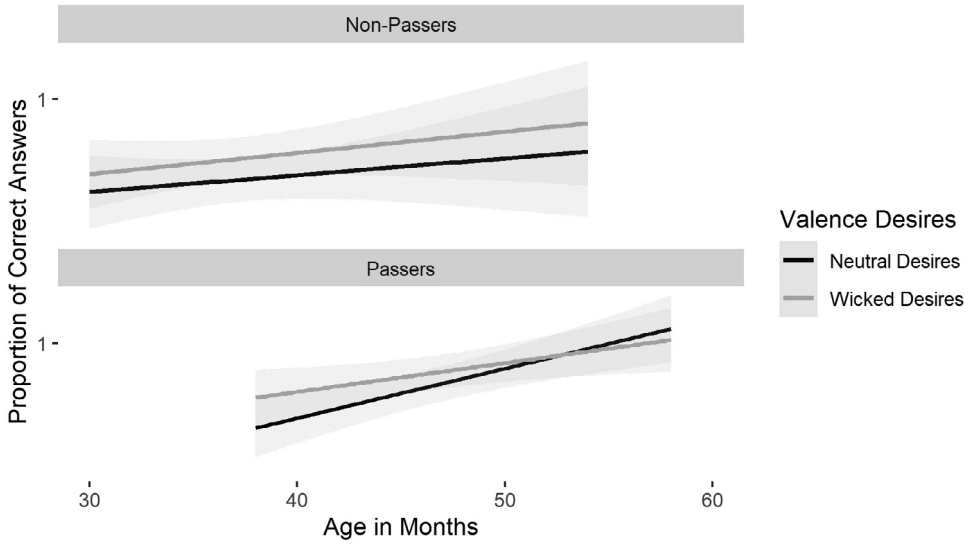


Fig. 3. Proportions of correct answers by age, valence of desires, and false belief understanding (non-passers vs. passers).

directly compared children's performance in desire reasoning with their subjective belief reasoning capacity.

The main findings of the current study were the following. First, younger children were generally better in reasoning about desires than about beliefs. This was the case not only for neutral desires but also for wicked desires. Older children succeeded in both belief and desire ascription. Second, younger children in our study were better in reasoning about wicked desires than about neutral desires. Third, we found no relation between wicked desires and belief reasoning.

Overall, thus, the current findings are compatible with the predictions of the asymmetry account. This account makes one clear prediction: Children develop an understanding of desires before an understanding of beliefs. In line with this prediction, the current results indicate that younger children were more proficient in ascribing both value-compatible and value-incompatible desires than in ascribing beliefs, whereas older children succeeded in both.

In contrast, the current results are not in line with the predictions of the symmetry account in several respects. First, the symmetry account predicts that young children should be able to reason about neutral desires because these can be grasped on the basis of a purely objective teleological reasoning scheme. In contrast, young children should fail on tasks that require the ascription of value-incompatible desires because these cannot be understood on the basis of objective teleology but rather require truly subjective reasoning. However, the results of the current study showed that children not only had no such difficulties but also were, in fact, even better at reasoning about value-incompatible desires. Whether this is a chance finding or reflects a genuine effect is currently unclear. In addition, if it does reflect a genuine effect, it remains unclear from the current findings alone whether the difference is due to the difference in the kind of desires (neutral vs. wicked) or is due to some correlated difference, for example, in the salience and relevance of the scenarios (naturally, the wicked desire scenarios may appear to be more relevant and salient). Future research will need to test these possibilities against each other more systematically. Second, the symmetry account predicts that because genuine desire reasoning and belief reasoning share an underlying core capacity (a grasp of participant perspective), they should emerge in tandem. So far, evidence for this assumption came from indirect findings that children begin to reason about value-incompatible desires and beliefs around the same age. Here, we took a more direct approach than comparing ages of onset and investigated inter-task correlations. In contrast to the predictions of the symmetry account, we did not find any correlations between false belief and wicked desire ascription.

The current findings stand in contrast to the results of two previous lines of research that provided evidence for the symmetry account. First, as reviewed above, previous research on children's developing understanding of wicked desires used emotion ascription as its dependent measure. The central finding was that children ascribe subjective wicked desire-dependent emotions (such that an agent feels good after realizing his or her desired bad ends) only from 4 or 5 years of age (Yuill, 1984; Yuill et al., 1996). Why, then, is there this discrepancy between our findings and those previous results? Clearly, from the current results alone we cannot tell, and thus currently we can only speculate. But the following seems plausible: Emotion ascription involves extraneous complexities that do not apply in the case of memory-for-complements tasks. In general, ascribing emotions based on mental states appears to be inferentially more demanding than ascribing the mental state itself (Harris et al., 1989). This is even more true in the case of desires conflicting with moral norms. This case requires children to coordinate the representations of an outcome for the victim that causes negative emotions (e.g., being hurt) with positive emotions on the desirer's side (having succeeded in hurting someone). Compare this with the case of neutral desires, in which neutral or slightly positive outcomes and emotions on the "victim's" side need to be paired with positive emotions on the desirer's side. One can easily see how the first case adds further challenge to the task. More generally, it is not even completely clear what the normatively correct answer is in such wicked desire cases. Mature reasoners would at least ascribe some form of mixed emotion (e.g., "in some sense she is glad because of her 'success', but true happiness looks different"). Developmentally, indeed, older children from around 10 years of age stop ascribing purely positive emotions to the agent. Instead, they add a negative notion to account for some form of remorse on the side of the successful yet wicked desirer (Yuill et al., 1996).

Second, previous research on children's understanding of incompatible desires in the context of competition has suggested that children acquire a notion of the subjectivity of desires only from around 4 or 5 years of age (Priewasser et al., 2013). How can we explain the discrepancy between those findings and the current findings? Again, from the current study alone we cannot conclusively tell, but the following seems plausible: Competitive moves may have been difficult for young children not for cognitive reasons (understanding the incompatibility of one's own subjective desires and those of their opponents) but rather for broadly motivational or ethical ones; children may have well understood the different subjective desires but might not have translated this into competitive action because they found it difficult to overcome norms of politeness or may have simply cared more about playing together than about winning. Indeed, when in a recent study children were asked directly in such competitive scenarios, they did not show difficulties in ascribing their own and their opponents' mutually incompatible desires (Proft et al., 2021). At this stage of inquiry, thus, the empirical situation remains complex. Currently, we can only speculate in post hoc ways why different approaches (asking about neutral or wicked desires directly or about desire-dependent emotions or recording competitive actions) reveal different developmental patterns. Future research needs to go beyond post hoc attempts at making sense of such seemingly contradictory patterns of findings and investigate the development of understanding subjective desires and beliefs in different forms and with different types of measures in more systematic, more comprehensive, a priori planned ways.

To summarize, the current study investigated children's developing understanding of beliefs and various forms of desires in order to test competing predictions of two broad classes of accounts against each other. In contrast to previous studies, arguably it used the purest measure for desire understanding, memory-for-complements, and directly compared subjective belief and desire reasoning. The results suggest that genuine subjective understanding of desires and understanding of beliefs do not emerge in tandem. Instead, they suggest an asymmetric development; a concept of desires that can be relativized to subjective standpoints is already present before children can reason about beliefs in comparably subjective ways. However, how sophisticated this early subjective conception of desires is, and what exactly its scope and limits are, needs to be explored more systematically in future research.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jecp.2021.105268.

References

Apperly, I. A., & Butterfill, S. A. (2009). Do humans have two systems to track beliefs and belief-like states? *Psychological Review, 116*, 953–970.
Choe, K. S., Keil, F. C., & Bloom, P. (2005). Children's understanding of the Ulysses conflict. *Developmental Science, 8*, 387–392.
de Villiers, J. G., & Pyers, J. E. (2002). Complements to cognition: A longitudinal study of the relationship between complex syntax and false-belief-understanding. *Cognitive Development, 17*, 1037–1060.
Fizke, E., Barthel, D., Peters, T., & Rakoczy, H. (2014). Executive function plays a role in coordinating different perspectives, particularly when one's own perspective is involved. *Cognition, 130*, 315–334.
Flavell, J. H. (1988). The development of children's knowledge about the mind: From cognitive connections to mental representations. In J. W. Astington, P. L. Harris, & D. R. Olson (Eds.), *Developing theories of mind* (pp. 244–267). New York: Cambridge University Press.
Fodor, J. A. (1975). *The language of thought* (Vol. 5) Cambridge, MA: Harvard University Press.
Gergely, G., & Csibra, G. (2003). Teleological reasoning in infancy: The naive theory of rational action. *Trends in Cognitive Sciences, 7*, 287–292.
Gordon, R. M. (1986). Folk psychology as simulation. *Mind & Language, 1*, 158–171.
Hadwin, J., & Perner, J. (1991). Pleased and surprised: Children's cognitive theory of emotion. *British Journal of Developmental Psychology, 9*, 215–234.
Harris, P. L., Johnson, C. N., Hutton, D., Andrews, G., & Cooke, T. (1989). Young children's theory of mind and emotion. *Cognition & Emotion, 3*, 379–400.
Kristen, S., Thoermer, C., Hofer, T., Aschersleben, G., & Sodian, B. (2006). Skalierung von theory of mind-Aufgaben. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie, 38*, 186–195.
Lichtermann, L. (1991). *Young children's understanding of desires: Third year project report*. Unpublished manuscript, Laboratory of Experimental Psychology, University of Sussex.
Moore, C., Jarrold, C., Russell, J., Lumb, A., Sapp, F., & MacCallum, F. (1995). Conflicting desire and the child's theory of mind. *Cognitive Development, 10*, 467–482.
Perner, J., & Esken, F. (2015). Evolution of human cooperation in *Homo heidelbergensis:* Teleology versus mentalism. *Developmental Review, 38*, 69–88.
Perner, J., Priewasser, B., & Roessler, J. (2018). The practical other: Teleology and its development. *Interdisciplinary Science Reviews, 43*, 99–114.
Perner, J., & Roessler, J. (2010). Teleology and causal understanding in children's theory of mind. In J. H. Aguilar & A. Buckareff (Eds.), *Causing human action: New perspectives on the causal theory of action* (pp. 199–228). Cambridge, MA: MIT Press/Bradford Book.
Perner, J., & Roessler, J. (2012). From infants' to children's appreciation of belief. *Trends in Cognitive Sciences, 16*, 519–525.
Perner, J., Sprung, M., Zauner, P., & Haider, H. (2003). Want that is understood well before say that, think that, and false belief: A test of de Villiers's linguistic determinism on German-speaking children. *Child Development, 74*, 179–188.
Priewasser, B., Roessler, J., & Perner, J. (2013). Competition as rational action: Why young children cannot appreciate competitive games. *Journal of Experimental Child Psychology, 116*, 545–559.
Proft, M., Hoss, C., Manfredini Paredes, K. M., & Rakoczy, H. (2021). Do children understand desires before they understand beliefs? A comparison of 3-year-olds' grasp of incompatible desires, competitive games and false beliefs. *Cognitive Development, 57*, 101009.
Rakoczy, H. (2010). Executive function and the development of belief–desire psychology. *Developmental Science, 13*, 648–661.
Rakoczy, H., Warneken, F., & Tomasello, M. (2007). "This way!", "No! That way!"—3-year-olds know that two people can have mutually incompatible desires. *Cognitive Development, 22*, 47–68.
Repacholi, B. M., & Gopnik, A. (1997). Early reasoning about desires: Evidence from 14- and 18-month-olds. *Developmental Psychology, 33*, 12–21.
Searle, J. R. (1983). *Intentionality: An essay in the philosophy of mind*. New York: Cambridge University Press.
Siegal, Michael (1999). Language and thought: the fundamental significance of conversational awareness for cognitive development. *Developmental Science, 2*(1), 1–34. https://doi.org/10.1111/1467-7687.00048.
Steglich-Petersen, A., & Michael, J. (2015). Why desire reasoning is developmentally prior to belief reasoning. *Mind & Language, 30*, 526–549.
Wellman, H. M., & Banerjee, M. (1991). Mind and emotion: Children's understanding of the emotional consequences of beliefs and desires. *British Journal of Developmental Psychology, 9*, 191–214.
Wellman, H. M., & Liu, D. (2004). Scaling of theory-of-mind tasks. *Child Development, 75*, 523–541.

Wellman, H. M., & Woolley, J. D. (1990). From simple desires to ordinary beliefs: The early development of everyday psychology. *Cognition, 35*, 245–275.
Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition, 13*, 103–128.
Yuill, N. (1984). Young children's coordination of motive and outcome in judgements of satisfaction and morality. *British Journal of Developmental Psychology, 2*, 73–81.
Yuill, N., Perner, J., Pearson, A., Peerbhoy, D., & Ende, J. (1996). Children's changing understanding of wicked desires: From objective to subjective and moral. *British Journal of Developmental Psychology, 14*, 457–475.