



Theory of mind and wisdom: The development of different forms of perspective-taking in late adulthood

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How does perspective-taking develop over the lifespan? This question has been investigated in two separate research traditions, dealing with theory of mind (ToM) and wisdom, respectively. Operating in almost complete isolation from each other, and using rather different conceptual approaches, these two traditions have produced seemingly contradictory results: While perspective-taking has been consistently found to decline in old age in ToM research, studies on wisdom have mostly found that perspective-taking remains constant or sometimes even increases in later adulthood. This study sought to integrate these two lines of research and clarify the seemingly contradictory patterns of findings by systematically testing for both forms of perspective-taking and their potential cognitive foundations. The results revealed (1) the dissociation in developmental patterns between ToM perspective-taking (declining with age) and wisdom-related perspective-taking (no decline with age) also held – documented here for the first time – in one and the same sample of younger versus older adults; (2) this dissociation was of limited generality: It did not (or only partly) hold once the material of the two types of tasks was more closely matched; and (3) the divergent developmental patterns of ToM perspective-taking versus wisdom-related perspective-taking could be accounted for to some degree by the fact that only TOM perspective-taking was related to developmental changes in fluid intelligence.

The capacity to take the perspective of others, friends and foes alike, is fundamental to most aspects of our daily social life. Perspective-taking has long been studied in developmental and comparative psychology, and more recently in cognitive neuroscience, under the rubric of ‘theory of mind’ (ToM). Traditionally, the main focus of this line of research has been on the ontogenetic emergence of ToM in young children (Perner, 1991; Wellmann, Cross, & Watson, 2001; Wimmer & Perner, 1983). More recent work, however, has begun to investigate the development of ToM over the lifespan and has found that even in adulthood, there remains both interindividual and situational variations as well as limitations in the proficiency of perspective-taking (Apperly, 2013; Epley, Caruso, & Bazerman, 2006; Keysar, Lin, & Barr, 2003). As to age differences, this research has revealed that different aspects of ToM show more or less consistent decline. More specifically, regarding more cognitive forms of ToM, older subjects are less competent at

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ascribing complex beliefs and other epistemic states. Similarly, older adults reveal less competence in more emotional forms of ToM such as emotion recognition from static and dynamic displays (for an overview, see the recent meta-analysis by Henry, Phillips, Ruffman, & Bailey, 2013).

Age differences in perspective-taking have also been studied in a different and totally separate research tradition under the rubric of 'wisdom'. Although different schools of thought have focused on somewhat different facets of wisdom and have proposed different methods to assess these facets (e.g., Ardel, 2004; Baltes & Staudinger, 2000; Grossmann *et al.*, 2010; Labouvie-Vief, 2011; Sternberg, 1998), they all consider perspective-taking or the capacity to understand, coordinate and integrate diverging perspectives, as being at the core of wisdom. As is true for many domains of functioning, age differences in perspective-taking and related aspects of wisdom are dependent on the age relevance and age familiarity of a given wisdom task, the specific instructions, or both (e.g., Mickler & Staudinger, 2008; Thomas & Kunzmann, 2014). However, on a general level and when using age-neutral tasks and instructions, perspective-taking seems to remain stable across most of adulthood (see Staudinger, 1999; Staudinger & Glueck, 2011; for review). There even is recent evidence suggesting that perspective-taking can increase across age groups when assessed via tasks involving real-life social conflicts between groups or individuals and instructions that involve relatively concrete questions about how these conflicts could be resolved or what the actors might do, etc. (Grossmann, Na, Varnum, Kitayama, & Nisbett, 2013; Grossmann *et al.*, 2010; Grossmann *et al.*, 2012). Answers to such questions were analysed on six dimensions considered to tap essential aspects of wise thinking, and one of these dimensions was 'perspective-taking', measuring how well participants can put themselves into the shoes of the protagonists involved and reason how they themselves would see the world from the point of view of the protagonists. The crucial result was that older adults in the United States¹ consistently outperformed younger adults on this dimension (even though the two groups were matched in terms of education, etc.).

From a theoretical point of view, it is surprising that these two lines of research on the development of perspective-taking have been pursued in isolation from each other and have hardly made any connections with one another. Relatedly, from an empirical point of view, the two sets of findings from these two traditions – consistent decline in perspective-taking in the ToM tradition in contrast to stability (and, if the tasks are particularly age friendly, even increases) in perspective-taking in the wisdom tradition – pose a fundamental integration challenge: How is it possible, to put it somewhat polemically, to get more egocentric in old age, as ToM research suggests, while at the same time maintain or even increasing one's level of perspective-taking, as wisdom research suggests? This study aimed at contributing a first step towards the conceptual integration of ToM and wisdom research on the development of perspective-taking (towards what could be called 'WisToM' research) and towards clarifying the empirical puzzle raised by the seemingly inconsistent sets of findings. To this end, we systematically tested for perspective-taking in the ToM- and in the wisdom sense and for their potential cognitive foundations and correlates in the same populations of younger and older adults, to address three guiding questions:

¹ Interestingly, the pattern of results was different in one study for a Japanese sample (Grossmann *et al.*, 2013): Young Japanese adults outperformed young US American adults on the wisdom scales, but the old Japanese adults differed in wisdom neither from the young Japanese adults nor from the old US adults. In other words, it seems as if – in contrast to US adults – Japanese adults reach the highest level of wisdom earlier (and then remain there across adulthood).

1. How reliable is the pattern of diverging developmental curves for perspective-taking in ToM compared to wisdom tasks?
2. How robust and general is the pattern of diverging developmental curves in the two types of tasks?
3. What might be the factors underlying the divergent developmental curves of the two kinds of perspective-taking (in the ToM- and in the wisdom sense)?

To address the first question, because this had never been made so far, we tested whether one and the same population of young versus old adults would show the dissociation between age-related increase in wisdom and decrease in ToM performances.

To address the second question, we tested subjects on the standard ToM and wisdom tasks that were previously used. In addition, we then went on to use novel ToM and wisdom tasks that – in contrast to all previous studies – were matched in terms of structure, content, and material as far as possible. In previous research, one type of tasks with a certain kind of material has been used in the one (ToM) line of research to test perspective-taking, while completely different kinds of tasks with very different material have been used in the other (wisdom) kinds of tasks. For example, cognitive ToM has typically been tested by presenting subjects with complex stories about multiple protagonists with interlocking beliefs about each other and asking them the test question why one of the protagonists said or did something (e.g., a bank robber, after robbing the bank, is being stopped by a traffic policeman who just wants to control his driver licence (Happé, Winner, & Brownell, 1998). The bank robber says ‘Okay, you got me’ and surrenders. Why did he do that?). Perspective-taking in the wisdom sense, in contrast, has been tested by presenting subjects with stories about interpersonal or intergroup conflicts and asking them in rather general terms how the story would unfold and what the two parties could do to resolve the conflict (Grossmann *et al.*, 2010; Grossmann *et al.*, 2012; Grossmann *et al.*, 2013; Kunzmann & Baltes, 2003; Staudinger, 1999). Against this background, it might be that the divergent findings regarding ToM and wisdom were a function of the different particular materials and story contents used. In this study, therefore, we developed new story contents that were suitable for both ToM-type and wisdom-type tasks. For example, we invented complex *menage à trois*-stories involving interlocking attitudes between three protagonists such as jealousy, false beliefs by person 1 about person 2’s beliefs about person 3, etc. In the ToM version, the crucial test question was then why one of the protagonists had done or said something (such that the correct answer required the ascription of complex mental states). In the wisdom version, in contrast, the crucial test questions were, following Grossmann *et al.* (2010), how the situation would unfold and what the protagonists could do to solve the conflict etc.

With regard to the third question, various factors may underlie diverging developmental patterns in wisdom versus ToM perspective-taking tasks. For example, the different kinds of tasks may tap different forms and processes of detached perspective-taking versus engaged perspective coordination, or they may address different motivational sets (these possibilities will be discussed in more detail in the Discussion section). In this study, in a first step to address potential cognitive correlates and foundations of the two forms of perspective-taking, we investigated one obvious possibility: The divergent curves might simply reflect more general, well-known developmental trends in fundamental aspects of cognitive functioning in the mechanics of cognition (fluid intelligence) such as executive function (e.g., Eppinger, Kray, Mecklinger, & John, 2007; Jacques & Marcovitch, 2010; Kray, Eber, & Lindenberger, 2004; von Hippel, 2007; Zelazo,

Craik, & Booth, 2004) versus the pragmatics of cognition (crystallized intelligence), respectively. Regarding ToM, many studies have found evidence that the decline in perspective-taking is at least partly mediated by domain-general decline in processing speed, executive functioning, working memory, and related capacities typically subsumed under the heading of ‘fluid intelligence’ (e.g., Bailey & Henry, 2008; McKinnon & Moscovitch, 2007; Rakoczy, Harder-Kasten, & Sturm, 2012; for an overview, see Henry *et al.*, 2013). And wisdom, although related to many cognitive covariates, has often been connected in particular ways, both conceptually and empirically, to crystallized intelligence (e.g., Grossmann *et al.*, 2010; Staudinger, Lopez, & Baltes, 1997; Staudinger & Pasupathi, 2003). In this study, therefore, we tested whether the developmental patterns in perspective-taking in the ToM and in the wisdom sense could be accounted for (were mediated by) developmental patterns in fluid and crystallized intelligence, respectively.

Method

Participants

We tested 80 German adults, 40 each in the age groups of younger (18–31 years, $M = 24.35$ years, $SD = 3.76$, 25 female) and older adults (61–78 years, $M = 68.43$ years, $SD = 4.58$, 23 female). Recruitment and testing was distributed equally among two German cities (Göttingen and Leipzig²). Younger participants were recruited by advertisements on bulletin boards in the universities and via personal contacts of the investigators. Older participants were recruited via advertisements in university lectures for seniors and in health care institutions for elderlies. The two age groups were comparable considering their mean years of education, $M_{\text{young}} = 16.11$, $SD = 2.78$; $M_{\text{old}} = 14.71$, $SD = 3.88$; $t(70.70) = 1.85$, *ns*. Subjects were informed that life experiences and life knowledge were being investigated, and they agreed to take part in an approximately 2-hr individual interview. To avoid exhaustion, at least one break was included in the session. As a small compensation for participation, all subjects took part in a lottery in which they could win one of 20 cinema and café vouchers (each 10€). All subjects spoke German at least on a C1-level and came from mixed (mostly middle class) socio-economic backgrounds. Two additional subjects were tested but excluded from the final sample due to technical problems and severe problems of task comprehension.

Procedure and materials

Each subject was tested in a single session in which we tested for perspective-taking in the wisdom sense and in the ToM sense, as well as for potential cognitive covariates such as processing speed, executive functions (EF), and crystallized intelligence. First of all, wisdom and ToM were tested with established tests (following Grossmann *et al.*, 2010 and Happé *et al.* 1998, respectively). To compare wisdom and ToM more stringently, however, novel tasks were designed with one and the same kind of scenario and content that could be administered in both a wisdom and a ToM version.

² As preliminary tests did not yield any differences between the two samples in any of the target measures, they were collapsed for all subsequent analyses.

All in all, thus, each subject received two kinds of wisdom tasks³ – they first answered two established tasks following Grossmann *et al.* (2010) and then two novel tasks, as well as two types of ToM tasks – established ones following Happé *et al.* (1998) and novel ones (see Table 1 for an overview). The order of presentation of novel wisdom, novel ToM, and established ToM tasks following Happé *et al.* (1998) was counterbalanced. Before answering the wisdom tasks, participants were trained in the method of thinking aloud, as used in the Berlin wisdom studies: Participants were asked to think about a fictive person, who is in a described problem situation, thereby considering concrete as well as general aspects, there are no right or wrong answers. Lastly, each subject filled in the multiple-choice word test (MWT-B) and was given the trail making test (TMT; see below).

Established wisdom task after (Grossmann et al., 2010)

Participants read (German translations of) two letters that, they were told, were addressed to an advice column that concerned interpersonal conflicts. Participants were then asked to think aloud in response to the following four questions: (1) How did the story developed after this letter? (2) Why do you think it happened as you said? (3) What was the final outcome of this conflict? (4) What do you think should be done in this situation? Answers were transcribed and then content coded by two independent, trained raters according to one of the six wisdom criteria by Grossmann *et al.* (2010); the one called ‘perspective-shifting from one’s own point of view to the point of view of people involved in the conflict’. Applying the coding scheme used in the studies by Grossmann (2012), answers were coded in the following ways:

High perspective-shifting [2 points]: If the answer indicated that the participant put herself into the story to analyse the problem/situation *or* to look at the problem/situation from the view point of one of the protagonists of the story.

Some perspective-shifting [1 point]: Indications for either of the upper two are given, but they are expressed not clearly enough or not repeatedly.

No or very little perspective-shifting [0 points]: None of the above.

Established ToM tasks after Happé et al. (1998)

German translations of four of the original *Strange stories* from Happé *et al.* (1998) were used, and participants read short stories about social interactions and had to make inferences about mental states of the protagonists. Furthermore, four of the original control stories were tested in which inference of comparable complexity had to be drawn, yet not about mental states but rather about physical causation. Following the coding scheme of Happé *et al.* (1998), for each story, the participant’s answer was given:

2 points: Correct reference to complex mental states behind the behaviour in question, for example, in the bank robber scenario ‘he thought he was caught because he did not know that the policeman only was a traffic policeman trying to control his driver’s license’.

1 point: Some, yet incomplete, reference to some mental states behind the behaviour in question, for example, in the bank robber scenario ‘because he thought he was caught’.

0 point: No reference to relevant mental states at all.

³ As this study was part of a bigger project, subjects also participated in yet another type of wisdom task (two tokens of Berlin wisdom tasks) in this session that was not part of the present study.

Table 1. Types, description, dependent measure, example, and coding scheme of ToM and Wisdom tasks used

Task	Dependent measure	Example	Coding
Established wisdom tasks after Grossmann <i>et al.</i> (2010)	<p>Test questions how the events could unfold:</p> <ul style="list-style-type: none"> • How did the story developed after this letter? • Why do you think it happened as you said? • What was the final outcome of this conflict? • What do you think should be done in this situation? 	<p>Dear A., my husband, 'Ralph', has one sister, 'Dawn', and one brother, 'Curt'. Their parents died 6 years ago, within months of each other. Ever since, Dawn has once a year mentioned buying a headstone for their parents. I'm all for it, but Dawn is determined to spend a bundle on it, and she expects her brothers to help foot the bill. She recently told me she had put \$2,000 aside to pay for it. Recently Dawn called to announce that she had gone ahead, selected the design, written the epitaph and ordered the headstone. Now she expects Curt and Ralph to pay 'their share' back to her. She said she went ahead and ordered it on her own because she has been feeling guilty all these years that her parents didn't have one. I feel that since Dawn did this all by herself, her brothers shouldn't have to pay her anything. I know that if Curt and Ralph don't pay her back, they'll never hear the end of it, and neither will I. What should I do about this?</p>	<p>[0] No acknowledgement of others' perspective [1] Some acknowledgement of others' perspective [2] A great deal of acknowledgement of others' perspective</p>
Novel wisdom tasks		<p>Dear A., Sarah is a young woman and has been friends with a couple called Lena and Markus. She met them at the same time and is a good friend of both of them. What disturbs Sarah is, that during times in which the couple is fighting each other, Lena wants Sarah to stand on her side. Lena wants Sarah to be mad at Markus, too</p> <p>On the other hand, Markus never asked her to take sides with him. Sarah doesn't feel good at all to sides with Lena since she feels like being friends with both of them and she doesn't want to hurt Markus or to betray their friendship. Sarah would rather be left out of the couples arguments and not have to choose sides, but she doesn't know how to explain this to Lara. Once, as the wife was on the phone with Sarah, Markus was in the hall and thus overheard their parts of the conversation: 'Oh Sarah, he is so stubborn! Couldn't you try talking to him? Please. . . Oh, thanks, that would be great!' Markus is indignant and goes off. Sarah is feeling bad after the talk Markus into something. She decides to write a letter to Lena and to finally tell her, that she wants to be left out of their marital arguments. Afterwards she decides to go to Markus to talk to him and to excuse herself for breaking up the contact. When she enters his office, she hesitantly greets him and asks him how he was doing. He replies grumpily 'Oh, just go and tell her there was no chance to talk to me'</p>	

Continued

Table 1. (Continued)

Task	Dependent measure	Example	Coding
Novel ToM tasks	Test question why an agent said or did something (requiring inferences about complex mental states), for example, why did he say this?		<p>[0] No reference to relevant mental states at all, for example, reference to white lie or wanting to spare her parents' feelings</p> <p>[1] Some, yet incomplete, reference to some mental states behind the behaviour: in question, for example, more general reference to trait (she's well brought up) or emotion (she thinks it's better than no present at all)</p> <p>[2] Correct reference to complex mental states behind the behaviour: in question</p>
Established ToM task after Happé et al. (1998)		Helen waited all year for Christmas, because she knew at Christmas she could ask her parents for a rabbit. Helen wanted a rabbit more than anything in the world. At last Christmas Day arrived, and Helen ran to unwrap the big box her parents had given her. She felt sure it would contain a little rabbit in a cage. But when she opened it, with the whole family standing round, she found her present was just a boring old set of encyclopedias, which Helen did not want at all! Still, when Helen's parents asked her how she liked her Christmas present, she said, 'It's lovely, thank you. It's just what I wanted'	
Control tasks for established ToM task after Happé et al. (1998)	Test question why something happened (requiring inferences about complex non-mental causal relations), for example why did the alarm go off?	A burglar is about to break into a jewellers shop. He skilfully picks the lock on the shop door. Carefully he crawls under the electronic detector beam. If he breaks this beam it will set off the alarm. Quietly he opens the door of the store-room and sees the gems glittering. As he reaches out, however, he steps on something soft. He hears a screech and something small and furry runs out past him, towards the shop door. Immediately the alarm sounds	<p>[0] Reference to irrelevant or incorrect facts (e.g. the animal's screech set off the alarm)</p> <p>[1] Reference to burglar setting of the alarm, for example, being startled by animal and so crossing beam</p> <p>[2] Reference to animal, which the burglar disturbed, setting off the alarm</p>

Novel wisdom/ToM tasks

These novel tasks were developed, combining features of the two above-described wisdom and ToM tasks, to test ToM as well as perspective-taking in the wisdom sense with the very same kind of material. The scenarios featured complex, fundamental, and problematic social interactions. The scenarios were structurally similar to the established wisdom tasks used by Grossmann and colleagues in that they featured complex interpersonal conflicts, and they were structurally similar to established ToM tasks by Happé and colleagues in that there was a crucial act or speech act by a protagonist that could only be understood by complex, second-order mental state ascription (see the bank robber example). For example, in one scenario, there is a married couple and a single friend of theirs. The friend knows and likes both wife and husband equally well, but the wife tries to make her take sides with her in cases of marital dispute which the friend finds inappropriate. After one such dispute, the wife talks to the friend on the phone asking her ‘He’s so stubborn. Couldn’t you talk to him?’ The husband overhears this phone conversation, gets angry, and leaves. Meanwhile, after the phone call, the friend feels bad because she does not want to be drawn into the conflict and take sides. So she decides to write a letter to the wife telling her she does not want to be drawn into their marital conflicts, and then, she goes to talk to the husband. When she asks him how he was doing, he replies grumpily ‘Oh, just go and tell her there was no chance to talk to me’. Each such scenario could then be administered in a ToM version or in a wisdom version (for details, see Table 1.)

ToM version. In the ToM version, following the logic of the Happé *et al.* (1998) stories, the test question was why one of the protagonists said or did something (in the above example, why the husband said ‘Oh, just go and tell her there was no chance to talk to me’). Answers were coded, following the Happé *et al.* (1998) coding scheme with 0 to 2 points (in the above example: A fully correct 2-point answer would include reference to the fact that the husband did not know about the good intentions of the friend, thinking she was actually taking sides of the wife).

Wisdom version. In the wisdom version, following the logic of the Grossmann *et al.* (2010) tasks, participants were asked to think aloud about how the conflict might unfold and what could be made by the protagonists. Answers were coded according to the coding scheme used by Grossmann *et al.* (2010) with 0–2 points (in the above example: A fully correct 2-point answer would indicate that the participant put herself into the story to analyse the problem/situation or to look at the problem/situation from the view point of one of the protagonists of the story). In total, there were four scenarios of these novel wisdom/ToM tasks, and each subject received two of them as ToM tasks and two of them as wisdom tasks (where it was counterbalanced across subjects which scenario was administered in which version).

Coding procedure and inter-rater reliability of ToM and wisdom tasks

Participants’ answers on the ToM and wisdom tasks were audio-recorded and transcribed verbatim. Coding of the wisdom tasks was then performed from the transcripts by two raters blind to the hypotheses of the study. Inter-rater reliability, measured using Cohen’s weighted Kappa coefficient, was $\kappa = .83$ for coding of the tasks after (Grossmann *et al.*, 2010) and $\kappa = .84$ for the novel wisdom tasks. In case of the ToM tasks, a single rater coded all ToM tasks. A second rater coded a random sample of 20% of the participants’ answers. Inter-rater reliability was $\kappa = .90$ for the established ToM tasks and $\kappa = .72$ for the novel ToM tasks.

Covariate measures

Crystallized intelligence

The multiple-choice word test (MWT-B) by Lehrl (2005), in which participants need to find the only one correct word in lists of five words, was used as a standard measure of crystallized intelligence.

Fluid intelligence

As processing speed is generally considered one of the best proxies for fluid intelligence (Fry & Hale, 1996; Kail, 2000; Salthouse, 1996), participants completed the trail making test (TMT, Reitan, 1958). In Part A of the TMT, which is a standard measure of pure processing speed, numbers need to be connected in an ascending order. In Part B, participants have to coordinate two tasks, connecting numbers and letters in an alternating order (1-a-2-b, etc.). This allows one to compute a measure of executive function in the form of a difference score: $\text{time}_{\text{TMT-B}} - \text{time}_{\text{TMT-A}}$ (where the latter serves as a baseline measure of pure processing speed). Following the standard instructions, if participants made an error in either part, the mistake was pointed out to them and they were asked to correct it (with correction time included in completion time for task).

Results

Preliminary analyses

For the purpose of statistical analyses, the data of outliers (deviation of $> 3SD$ from the group mean) were removed from the analyses of the tasks in question (one older adult for the established ToM control task). In a preliminary analysis, we tested, as is usual in wisdom research, whether the length of participants' response to the wisdom questions differed as a function of age group. These analyses revealed that for neither the established, $M_{\text{Younger}} = 526.69$ words, $M_{\text{Older}} = 528.84$; $t(78) = .03$, n.s., $r = .01$, nor the novel wisdom tasks, $M_{\text{Younger}} = 454.70$, $M_{\text{Older}} = 446.85$; $t(77) = .15$, n.s., $r = .02$, response length differed by age group.

ToM and wisdom

Performance on the different types of tasks (depicted as mean proportion scores) as a function of age group can be seen in Figure 1. First, a multivariate analysis of variance with the five types of perspective-taking tasks as dependent variables and age group as independent variable revealed a general trend for overall differences between the age groups, using Pillai's trace $V = .13$, $F(5, 72) = 2.06$, $p = .08$, $\eta_p^2 = .13$. Subsequent separate analyses for each of the five dependent measures revealed that the age groups differed in their performance only in the established ToM tasks, $t(60.37) = 2.71$, $p < .01$, $r = .33$,⁴ while no age difference was found in matched control stories, $t(68.45) = 1.75$, ns. The novel ToM tasks developed here, in contrast, did not reveal age differences, $t(78) = 0.41$, ns. The two types of ToM tasks did not differ in difficulty, paired t -test, $t(78) = 1.01$, ns, and were correlated with each other ($r = .27$, $p < .01$).

⁴ In the case of directed hypotheses underlying the analysis (and there were two classes of such hypotheses: that older participants outperform younger ones on wisdom tasks, and younger ones outperform older ones on ToM tasks), corresponding one-tailed tests were used.

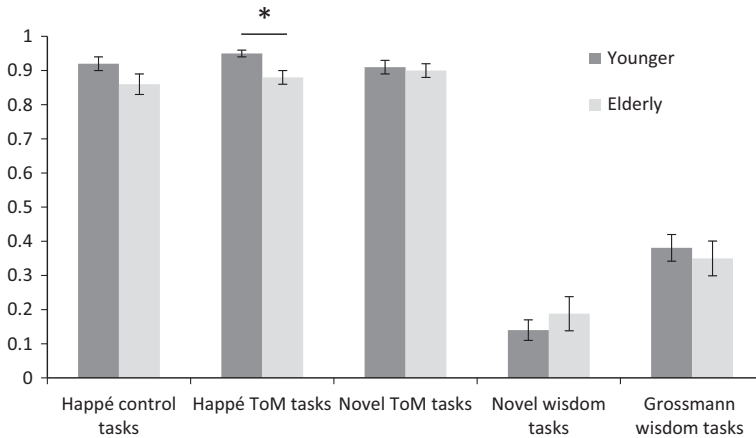


Figure 1. Mean proportion scores on the wisdom and theory of mind (including control) tasks as a function of age group. Error bars represent standard error of the mean (SEM). * $p < .05$; ** $p < .01$.

Concerning the established wisdom tasks of (Grossmann *et al.*, 2010), there was no difference between the older and the younger group, $t(72.82) = .49$, *ns*. Similarly, regarding the novel wisdom task, there was no difference between the two groups, $t(64.94) = .89$, *ns*. The two types of wisdom tasks did differ in difficulty from each other, paired *t*-test, $t(79) = 6.72$, $p < .001$, but were substantially correlated ($r = .50$, $p < .001$).

Cognitive covariate measures: Speed, EF, and crystallized intelligence

Table 2 shows the mean scores in the older and younger group on the tests of cognitive covariates. For the purpose of statistical analyses, the data of outliers (deviation of $>3SD$ from the group mean) were removed from the analyses of the tasks in question (two older adults for the processing speed measure, and two older and one younger adults for the EF measure). The remaining data showed that the younger adults outperformed the older ones on measures of processing speed (TMT-A) and executive function (TMT-B – TMT-A), whereas the older adults scored higher on crystallized intelligence than the younger ones.

Table 2. Mean scores (SD) on measures of speed, EF, and crystallized intelligence in the two age groups

	Young adults	Older adults	<i>t</i>	df	Significance level	Effect size <i>r</i>
Speed: time _{TMT-A} (sec.)	24.76 (7.58) (<i>N</i> = 40)	41.15 (13.20) (<i>N</i> = 38)	−6.68	58.39	$p < .0001$.66
Executive function: time _{TMT-B} – time _{TMT-A} (sec.)	18.15 (12.35) (<i>N</i> = 39)	33.59 (21.18) (<i>N</i> = 38)	−3.90	59.24	$p < .0001$.45
Crystallized intelligence: MWT-B	103.65 (10.32) (<i>N</i> = 40)	121.38 (10.69) (<i>N</i> = 40)	−7.54	78.00	$p < .0001$.65

Note. *N* = Number of participants included in the calculation.
* $p < .05$; ** $p < .01$.

Relations of ToM, wisdom, and cognitive covariate

Correlations of the different wisdom and ToM tasks with each other and with age and the cognitive covariates are depicted in Table 3. As expected, age was correlated with the established ToM measure of Happé *et al.* (1998). However, age correlated neither with the ToM control measure nor with the novel ToM measure. All ToM measures as well as the ToM control measure were significantly correlated with processing speed. Neither age nor crystallized intelligence was associated with any of the wisdom measures.

Relations of ToM with age when controlling for cognitive covariates

Against the background of these findings, we tested for the specificity of the relations of ToM with age with three types of control analyses. First, taking comparing across age group considered as categorical variable, an analysis of covariance revealed that the difference between older and younger adults disappeared once processing speed was included as a covariate, $F(1, 75) = .45, p = .51, \eta_p^2 = .01$. Second, treating age as a continuous variable, partial correlations and regression and mediation analyses were run with processing speed as the main potential covariate/mediating factor. Partial correlations of age and the ToM measures revealed that the correlations of age and established ToM measure of Happé *et al.* (1998) became non-significant once processing speed was controlled for, $r_{XY.M} = -.12, ns$. Third, a mediation analysis was also performed using bootstrapping method with bias-corrected confidence estimates (Preacher & Hayes, 2004; calculated using a PROCESS procedure for SPSS, Release 2.10 by Hayes, 2013). In this study, the 95% confidence interval of the indirect effect was obtained by 1,000 bootstrap samples. Results of the mediation analysis did not confirm the mediating role of processing speed in the relation between age and the performance in the established ToM measure of Happé *et al.* (1998; $B = -.0009, CI = -0.0021$ to 0.0002).

Discussion

Summary of the main findings

The present study had three main findings: *First*, the diverging lifespan-developmental patterns of perspective-taking in the ToM sense (decrease) and in the wisdom sense (no decrease) seem reliable: They can be found in one and the same sample of younger and older adults – when measured with established tests, the ToM stories after Happé *et al.* (1998) on the one hand, and the wisdom tasks after (Grossmann *et al.*, 2010) on the other hand. *Second*, there was, at least partial, evidence that the pattern of diverging developmental trends in perspective-taking measured in the established ToM versus wisdom tasks is not necessarily specific to perspective-taking as such, but might reflect the general pattern of the development of cognitive capacities over the lifespan. In particular, perspective-taking measured in ToM (in contrast to wisdom) tasks correlated negatively with age, but this negative correlation disappeared once processing speed was controlled for. *Third*, the pattern of diverging age differences in perspective-taking might be of somewhat limited robustness and generality: The effects did not consistently generalize to our newly devised tasks with new material that we developed here in order to have the same kinds of age-neutral scenarios and structures for the two types of tasks. Both the established and the novel wisdom tasks converged in showing no age effects.

Table 3. Correlations between all variables tested (outliers excluded pairwise)

	1. Age	2. Crystallized intelligence	3. Processing speed (TMT-A)	4. Executive function (EF) (TMT-B – TMT-A)	5. Established ToM tasks	6. ToM control tasks	7. Novel ToM tasks	8. Established wisdom tasks	9. Novel wisdom tasks
2	.64** N = 80								
3	.64** N = 78	.23*							
4	.44** N = 77	.29*	.29* N = 75						
5	-.34** N = 79	-.04 ns N = 79	-.29** N = 77	-.03 ns N = 76					
6	-.20 ns N = 78	-.16 ns N = 78	-.28* N = 76	-.16 ns N = 75	.28* N = 78				
7	-.07 ns N = 80	.03 ns N = 80	-.26* N = 78	-.06 ns N = 77	.27** N = 79	.23 ns N = 78			
8	-.06 ns N = 80	.10 ns N = 80	-.16 ns N = 78	.00 ns N = 77	.11 ns N = 79	-.12 ns N = 78	.02 ns N = 80		
9	.06 ns N = 80	.07 ns N = 80	.03 ns N = 78	.01 ns N = 77	.16 ns N = 79	-.12 ns N = 78	.07 ns N = 80.	.50** N = 80	

Note. N = Number of the participants included in calculations.

* $p < .05$; ** $p < .01$.

Age differences in perspective-taking: A matter of the contextual features of the task?

This suggests that patterns of age-related increase in perspective-taking in wisdom tasks found in previous studies (Grossmann *et al.*, 2010) may be a less robust phenomenon than initially assumed (see also Grossmann & Kross, 2014). But it does suggest, on the other hand, that performance in these different kinds of wisdom perspective-taking tasks converged (in showing constancy), and showed a pattern that was markedly different from the age-related decrease in the established ToM tasks. The novel and established ToM tasks, in contrast, diverged as follows: The latter differed from the former in showing no difference between the age groups whatsoever. Why the results of the novel ToM tasks diverged from those of the established ones remains currently unclear. One possibility is that the novel tasks, because they were designed in such a way that they could be administered in a wisdom version as well, that is, richer in context and content, were more suitable in form and content and therefore more motivating for the older participants than the rather restricted story vignettes of the established Happé *et al.* (1998) tasks (see below).

The relation of theory of mind and the mechanics of cognition

One specific question regarding the pattern of findings is why ToM was here related to some measures of the mechanics of cognition or fluid intelligence (processing speed) but not to others (EF). In fact, in this respect, the present findings add to a growing body of mixed findings regarding which aspects of general cognitive functioning might account for ToM decline in older age: Some studies suggest processing speed and/or general cognitive fluency are central (Sullivan & Ruffman, 2004), while others suggest it is EF that is fundamental (Duval, Piolino, Bejanin, Eustache, & Desgranges, 2011), and yet others suggest that processing speed and EF both account for some ToM decline, yet regarding different components of ToM (such as cognitive vs. emotional ToM) (Rakoczy *et al.*, 2012). Clearly, more systematic research is needed to explore the reasons for these divergent findings.

Cognitive foundations of diverging developmental patterns

The more general and crucial question flowing from the present findings is why exactly ToM versus wisdom tasks produce such divergent developmental patterns, and why they map differentially onto general cognitive capacities and processes in the way they seem to do (such that only ToM seems to be related to fluid intelligence). One possibility is that the different types of tasks used here and elsewhere, given their format and structure, pose different demands on aspects of fluid intelligence such as executive function. Standard ToM tasks, by their nature, require the inhibition (one central element of EF) of one's own perspective on the world when describing someone else's. And in fact there is empirical evidence that older adults are only less proficient at ToM tasks when these are such (like standard ToM tasks) that self-perspective inhibition is required, but perform as proficiently as younger adults when this inhibitory component of the task is removed (Bailey & Henry, 2008; for comparable findings with neuropsychological patients with inhibition deficits, see Samson, Apperly, Kathirgamanathan, & Humphreys, 2005). In contrast to standard ToM tasks, the wisdom tasks after (Grossmann *et al.*, 2010) do not require the subjects to suppress their own perspective in the same way. The tasks do require a subject to 'analyse the situation from the viewpoint of the people in the story', but that can be done such that the 'participant

put or immerse[s] him/herself into a story to analyse the problem/situation' (from the coding scheme of Grossmann *et al.*, 2010; see Grossmann, 2012). This, notably, is in contrast to other approaches to wisdom-based perspective-taking such as the Berlin wisdom paradigm of Baltes and colleagues. The tasks used in this paradigm are such that judgments are only considered as wise when they involve some kinds of suspense of one's own perspective and values (Kunzmann & Baltes, 2003; Thomas & Kunzmann, 2014). In other words, perspective-taking might have been conceptually and operationally defined in rather different ways in the two approaches (such that self-inhibition is strictly required in standard ToM tasks, but not so in the Grossmann *et al.*, 2010 wisdom tasks) and the divergent findings might therefore basically reflect the well-known developmental pattern of fluid intelligence in general and inhibition in particular. Generally, this is surely a plausible possibility and there is much evidence in favour of the claim that declining fluid intelligence over the lifespan underlies the decline in performance in standard ToM tasks (e.g., Bailey & Henry, 2008; German & Hehman, 2006; McKinnon & Moscovitch, 2007; Rakoczy *et al.*, 2012). But, as noted above, existing findings are mixed regarding the more specific question which aspect of fluid intelligence is crucial. While some of these studies suggest that it is executive function in particular that might be crucial, rather than (or at least in addition to) some other aspect of fluid intelligence, the results of the present study, compatible with a general role of fluid intelligence in the decline of ToM in old age, suggest it might rather be general processing speed rather than executive function that matters.

Another, related possibility is that the different tasks might have targeted different processes of more or less spontaneous perspective-taking. Recent work with children and adults has suggested that there is a form of spontaneous online perspective-taking that reveals itself in more open-ended measures such as children's narrative but that tends to get disrupted by closed test questions (Rubio-Fernández, 2013; Rubio-Fernández & Geurts, 2013). For example, 3-year-old children, failing standard false belief tasks, have been found to be able to 'solve' modified false belief tasks when, instead of interrupting the storyline (enacted with toy figurines) at one point and asking the standard test question 'where will he look for his X?', children are given the chance to continue the enactment of the story by moving the figurines themselves: They then move the protagonist to the location where he falsely believes the object he is looking for to be (Rubio-Fernández & Geurts, 2013). The capacity to answer closed test questions, in contrast, develops later in childhood and might be more dependent on general cognitive resources such as executive function. Now, the dependent measures in the present wisdom versus ToM tasks seem to differ in similar respects: The ToM test questions ('why did he say that?') surely disrupt the flow of the story and ask from outside the narrative, whereas the more open-ended wisdom question ('what could happen then?', etc.) resembles more the open-ended narrative measure of continuing the story enactment. One possibility is thus that the ToM perspective-taking tasks, tapping at elicited forms of perspective-taking, depended more on general cognitive resources and were therefore more sensitive to detrimental ageing than the wisdom tasks.

Finally, the differences in the ToM versus wisdom perspective-taking tasks might reflect the influence of motivational factors. Some recent work suggests that the decline in ToM performance in old age might be (at least partially) due to the fact that elderly subjects are less motivated than younger ones to perform in the kinds of perspective-taking tasks used in ToM research: When the participants' motivation to take part in the test session was extraneously manipulated by, for example, improving the relationship

between experimenter and subject or using participants' relatives as experimenters, the age difference in ToM tasks disappeared (Zhang, Fung, Stanley, Isaacowitz, & Ho, 2013). Given that social–emotional goals become more salient as individuals grow older (Carstensen, Isaacowitz, & Charles, 1999), such variations in the social nature of the task particularly enhance older but not younger adults' performance. It also deserves note that Grossman's tasks (as well as our newly developed tasks) are social in nature in at least two respects, they deal with an interpersonal conflict and the interview involves a dialogue between the participant and the experimenter. The Berlin wisdom tasks, in contrast, use a range of dilemmas that are not necessarily social in nature and the Berlin interview does not involve social exchange given that the participants think aloud about a general abstract question with no further intervention. The difference in the social nature across the two wisdom tasks could well be one factor that explains the past inconsistent evidence for age differences in wisdom-related perspective-taking with the Berlin tasks often showing stability and the Grossman tasks suggesting an increase across age groups (see U. Kunzmann, J. Nowak, S. Thomas, & S. Nestler, in preparation).

Motivational factors might have played a more nuanced role (going beyond the general motivation to participate in a test session) in the present study: The established ToM tasks, with their reduced structure and test questions might, have motivated the older participants less to pay close attention and perform at their best than the established wisdom tasks with their richer structure and more open questions. The fact that there was no age difference in the present study in the modified ToM tasks with their richer structure would fit such a speculation.

Conclusion

All in all, thus, the present study is the first to document systematically within one and the same sample of subjects that the development of perspective-taking in later adulthood is by no means a unitary and unidirectional phenomenon. How perspective-taking develops depends very much on which conception of it is in play and which aspect of it under study. Patterns of developmental change – such as decline in theory of mind or constancy/increase in wise perspective-shifting found in previous work – seem to reflect context-dependent multifaceted phenomena rather than generalized and uniform patterns of social cognitive ageing.

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Appendix: The novel ToM tasks

Task 1 'Retirement home'

September 25th, 2012

Dear A.,

for many years now, Liese takes care of her mother, who is very aged and who can't take care for herself by herself. Meanwhile the home care is so extensive and time-consuming, that Liese is overstrained managing the home care for her mother and her own job as a clerk. That's why she wants to find a place in a retirement home for her mother, so that the mother would receive professional care and security and also, she wouldn't be alone at no time.

But the mother's retirement pension alone won't pay for all expenses of the placement of the mother, thus Liese and her older sister Monica would have to pay as well. But Monica doesn't care for her mother and doesn't want to pay for the placement either, even though it would be financially more easy for her than for Liese. Since Monica has the guardianship for the mother, Liese needs her agreement to sign the mother in to a retirement home.

There had already been lots of fighting between the two sisters about this topic. Monica promised her mother to visit her today. But now she is calling to cancel her visit. Her sister Liese picks up the phone. As she got to know why Monica isn't coming, she gets angry with her sister:

You rather go for a coffee with your female friends, instead of eventually taking care of your mother? You never lift a finger for her! You don't even support her financially!

Unintentionally Liese's voice had grown louder and her mother, who had listened curiously since the phone had started ringing, had been overhearing everything. Liese didn't notice this and when Liese returned to her mother's room, she says:

Monica excuses herself. Unfortunately she can't come, because she still has to prepare a lot for her work tomorrow. She asked me to tell you, that she loves you and she will stop by another time.

Task 2 Sarah, Lena & Markus

Dear A., Sarah is a young woman and has been friends with a couple called Lena and Markus. She met them at the same time and is a good friend of both of them. What disturbs Sarah is, that during times in which the couple is fighting each other, Lena wants Sarah to stand on her side. Lena wants Sarah to be mad at Markus, too.

On the other hand, Markus never asked her to take sides with him. Sarah doesn't feel good at all to sides with Lena since she feels like being friends with both of them and she doesn't want to hurt Markus or to betray their friendship. Sarah would rather be left out of the couples arguments and not have to choose sides, but she doesn't know how to explain this to Lara. Once, as the wife was on the phone with Sarah, Markus was in the hall and thus overheard their parts of the conversation: 'Oh Sarah, he is so stubborn! Couldn't you try talking to him? Please... Oh, thanks, that would be great!' Markus is indignant and goes off. Sarah is feeling bad after the call, since she couldn't refuse Lena's request, but she absolutely doesn't want to talk Markus into something. She decides to write a letter to Lena and to finally tell her, that she wants to be left out of their marital arguments. Afterwards she decides to go to Markus to talk to him and to excuse herself for breaking up the contact. When she enters his office, she hesitantly greets him and asks him how he was doing. He replies grumpily 'Oh, just go and tell her there was no chance to talk to me'.

Task 3 Mother-in-laws

March 26th, 2013

Dear A.

Mrs Schmidt lives in her own house together with her son and her daughter-in-law. A year ago, also the mother of the daughter-in-law, Mrs Müller, moved into the house. Everybody thought this was a great idea to live together, thus neither had to live alone. Within the house everybody had his own living area and there was agreement to share and support each other in every-days work in the house.

Mrs Schmidt tried to make the adaptation phase for Mrs Müller easy and asked her to join her when going out for several activities with her friends. But Mrs Müller mostly acted dismissive, often, the people didn't seem good enough to her. Mrs Schmidt acquiesced in it for awhile. She even connived at being called 'lazy'. But after the following she had enough and wasn't to be won by any more attempts of her son to be reconciled. From that point on she doesn't want to have any contact with Mrs Müller and the atmosphere in the house is tense and wearing.

The following happened: Mrs Schmidt had been dozing snow at the yard, when Mrs Müller came by and started cleaning her part of the yard from snow. Shortly afterwards Mrs Schmidt went inside to watch her favourite TV series. Her son was calling and asked, whether she would need him to stop by at the grocer's shop. Mrs Schmidt told him that she had been dozing snow and that she didn't need anything.

The son drove home strait away and met Mrs Müller at the yard. He lauded her for diligently cleaning the yard. Mrs Müller answered him: 'Yes, I've been diligently! I finished the whole yard all by myself!'

Task 4 Child of divorce

April 7th, 2013

Dear A.

a young mother divorced from her husband a year ago, because of several reasons, that made a living together impossible to her. He hurt her a lot and it still hurts her having contact with him. But she is of the opinion, that it would be important for their son Daniel to see his father regularly. Out of this again and again contentious issues occur between the parents, which put a strain on the mother.

The father breaks appointments and acts uncooperatively in other ways. Last Sunday he brought the 7-year-old son back home only at 11 p.m., without his homework done different as agreed. Wednesday he didn't meet the appointment of picking up the son from school, thus the boy walked around the area all by himself. The mother was disappointed and angry at the father.

Today, Daniel is at his fathers' again and he had promised him to either go to the medieval market or to the movies, depending on the weather.

At the evening the disappointed son complains to his mother on the phone, that the father didn't keep his promise. The mother, too, is disappointed again, but answers: 'Don't be sad, darling. Maybe he wanted to save your trip for tomorrow? You will certainly do something fun tomorrow. Your father didn't mean to make you feel bad, he is trying!'