Theory of mind, mental state talk and social relationships in aging: the case of friendship

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Abstract

Objectives: Previous research has shown a decline in Theory of mind (ToM) associated with normal aging. However, very few studies have investigated older people's ToM using an ecological approach. The present study was designed to fill this gap and examine older people's frequency of mental state talk (MST) in describing their best friend, together with their performance on a traditional ToM task. In addition, the study examined the association between these two ToM indices and relationships with friends and family members.

Method: Seventy-two healthy older adults (age range 60-79) participated in the study. We measured ToM ability with a classic measure, the Faux Pas task, and selected the Describe-a-friend task to measure MST frequency; social relationships were investigated with the Lubben Social Network Scale. Correlation and regression analyses were performed.

Results: No significant association between MST and scores on the Faux Pas task emerged. In addition, MST (but not Faux Pas scores) significantly predicted friendships (but not family relationships) over and above general cognitive functioning.

Conclusion: These findings show the crucial distinction between possessing an ability and using it in daily life and suggest the need to move toward more ecological measures of older adults' abilities. In addition, the present results indicate that the spontaneous use of ToM ability, not the ability per se, impacted on older adults' social relationships.

Keywords: Theory of mind; mental state talk; aging; friendship

Recent studies have investigated Theory of mind (ToM, the ability to explain and predict others' behaviours in terms of mental states) in normal aging and have shown an age-related decline starting in the sixth decade (Cavallini, Lecce, Bottiroli, Palladino, & Pagnin, 2013). This decline seems to be, at least in part, independent from the general cognitive impairments related to the aging process (Henry, Phillips, Ruffman, & Bailey, 2013).

Studies cited above have mainly been conducted using tasks that evaluate the ability to understand other's mind rather than the propensity to *use* such mental states reasoning (Apperly, 2012; Meins, Fernyhough, Johnson, & Lidstone, 2006). This is surprising for at least two reasons. First, looking at the spontaneous use of mental states, rather than assessing ability in an experimental task, has greater ecological validity. Second, shifting from measuring ability to assessing the use of such ability allows to shed light on the links between ToM and older people's everyday life and social relationships.

Mental State Talk and Theory of Mind

One way of getting into the propensity to use ToM ability is by analysing the frequency of mental state talk (MST). MST refers to the frequency of the use of nouns/verbs/adjectives that refer to one's own or others' mental states (feelings, desires, thoughts). It reflects the tendency to apply ToM to interpret social behaviour. Research in this area has a long tradition and MST can be viewed as a privileged way to access ToM in an ecological way (de Rosnay & Hughes, 2006). Recently, researchers have started to expand the developmental scope of this area of investigation by considering adults (Barnes, Lombardo, Wheelwright, & Baron-Cohen, 2009; Byom & Turkstra, 2012; Hao, Su, & Chan, 2010) and new tasks have been developed. They usually require participants to tell stories starting from a very short plot (Lecce, Zocchi, Pagnin, Palladino, & Taumoepeau, 2010), or to describe people, such as friends (Meins, Fernyhough, & Harris-Waller, 2014).

Notably, while individual differences in MST and ToM ability appear strongly associated in preschoolers (Hughes & Dunn, 1998; Hughes, Lecce, & Wilson, 2007), available evidence suggests that later in life this association tends to become not significant (Barreto, Fearon, Osorio, Meins, & Martins, 2016; Devine & Hughes, 2017), suggesting a potential gap between ToM ability (as indexed by scores on a classic ToM task) and the use of MST in accounting for others' behaviour (Apperly, 2012).

To date only two studies on MST have been conducted in older adults (Pezzuti et al., 2015; Pezzuti, Longobardi, Milletti, & Ovidi, 2011). In both these studies, Pezzuti and colleagues have examined the frequency of older peoples' MST produced in a task originally designed to assess intentionality attribution in autistic children. The results revealed a strong variability in the frequency of MST that was related with depression, difficulty in identifying feelings, and interpersonal reactivity. These works are relevant as they show that the frequency of use of MST is a measure sensitive to variations in several domains, including social life in aging. However, Pezzuti and colleagues did not investigate the association between MST and scores on ToM tasks, limiting our knowledge on this issue in aging.

In the present study we followed up these studies and extended them in two important ways. Initially we examined MST in a dedicated task, known as the "Describe-a-friend" task (Meins et al., 2006); subsequently we related the frequency of MST to participants' scores on a classic ToM task. With respect to the foremost point, we selected the Describe-a-friend task for many reasons. First, this task is sensitive to individual differences (Meins et al., 2014). Second, we wanted an open-ended task to get an index of spontaneous use of mental state talk. Third, we wanted to make our results comparable to those on adults (Meins, Harris-Waller, & Lloyd, 2008; Szpak & Białecka-Pikul, 2015), to get an extended developmental trajectory on the relation between ToM and MST. Concerning the second point, we were interested in examining the association between the spontaneous use of MST and ToM ability

measured with a traditional task. Based on the previously reviewed evidence, we expected that they would not be strongly associated in older adults.

Theory of Mind, Mental State Talk and Social Relationships

To date direct evidence for the role that ToM plays in everyday social interactions is scarce, especially in the field of aging. The few existing studies in this area are mixed. While some authors have shown that the age-related decline in social functioning is due to a reduction in the ability to understand others' mental states (Bailey, Henry, & Von Hippel, 2008) or that ToM ability is significantly related with social functioning (Yeh, 2013), others did not report significant associations between ToM ability and social outcomes (Blanke, Rauers, & Riediger, 2016). More specifically, Blanke and colleagues found that the ability to correctly identify conversational partner's thoughts and feelings was globally unrelated with people's satisfaction with their social life. More recently, a study on Italian participants showed that ToM was related with both quantitative (e.g., frequency of contacts) and qualitative (e.g., satisfaction) aspects of relationships with friends, but not relatives, and that this correlation was moderated by the level of social motivation (Lecce et al., 2017). This result is important as it suggests that in order to have good and supportive friendships older people need to possess not only good ToM ability, but also have to be motivated to put this ability into use. This study shows, on one hand, that ToM in aging is a social tool that can or cannot be used and, on the other hand, suggests the need to consider more ecological and socially situated ToM tasks.

Our second aim was to investigate the associations between social relationships in aging and individual differences in ToM ability vs. the spontaneous use of ToM ability (as indexed by MST). Crucially, we considered both quantitative (e.g., frequency of contacts) and qualitative (e.g., satisfaction) aspects of the relationships (S. Cohen & Wills, 1985; Lubben & Gironda, 2003). Among all the possible social partners, we investigated family

members and friends, as older adults are oriented toward close and emotionally significant partners (Carstensen, 1992; Lansford, Sherman, & Antonucci, 1998). We examined these two relationships separately, as, even if both are crucial for successful aging (Hertzog, Kramer, Wilson, & Lindenberger, 2008), they fulfil different functions (Neyer, Wrzus, Wagner, & Lang, 2011), have different correlates (Huxhold, Miche, & Schüz, 2014) and follow different patterns of age-related changes (Wrzus, Hänel, Wagner, & Neyer, 2013).

On the basis of existing literature we expect ToM ability to be related to social relationships, especially friendships (Lecce et al., 2017). Additionally, in line with findings indicating MST as a measure of the propensity to use ToM ability in describing social interactions in everyday life (Bartsch & Wellman, 1995; Bretherton & Beeghly, 1982), we expect that MST would be a better predictor of friendships compared to ToM ability.

To summarize, the present research was designed to investigate the relationship between older people's social relationships (family vs. friends) and their ToM, by distinguishing between the level of ToM ability (as indexed by the Faux Pas task) and the spontaneous use of ToM ability in a narrative task (as indexed by MST). In doing so, we took into account general cognitive functioning as potential confounding variable, following literature indicating its association both with ToM (Charlton, Barrick, Markus, & Morris, 2009) and social relationships (Mortensen et al., 2014) in old age.

Materials and methods

Participants

The sample consisted of 72 older adults (56 female), aged 60 to 79 ($M = 68.38$, $SD = 5.01$). We selected this age range because past research has indicated that ToM decline starts at about 60 years, with an increase in the rate of decline after 80 years of age (Charlton et al., 2009). In addition, studies on social relationships have indicated that the reduction in social

networks commences approximately in the sixth decade of life (Antonucci, Akiyama, & Takahashi, 2004). With respect to the participants' level of education, 43% of the sample had a high school degree; 25% had a total of 8 years of education, while 20.8% achieved a bachelor/master's degree; a minority of participants reported either the lower academic status (primary education: 5.6%) or the highest educational level (more than a master's degree: 5.6%). Participants were from northern Italy and were recruited from among members of the University of the Third Age, a nationwide cultural and recreational aggregation centre. Italian was the first language for the entire sample. All participants achieved adjusted scores greater than 24 on the Mini-Mental State Examination (MMSE - Folstein, Folstein, & McHugh, 1975), a dementia screening measure ($M = 28.02$, $SD = 1.81$, range from 24.2 to 30). No tangible incentives were given to participants.

Measures

ToM ability: Faux Pas task

This test evaluates the ability to recognize mental states implicated in social gaffes (Gregory et al., 2002; Stone, Baron-Cohen, & Knight, 1998). We used four short stories containing a social slip (specifically stories n° 7, 13, 14 and 16, from the original test protocol available at https://www.autismresearchcentre.com/arc_tests). Stories were presented one at a time and followed by eight oral questions, investigating both mental states involved in the social gaffe and general comprehension of the story. Answers were audio recorded and scored later according to the manual. For each story, one point was given if the participant correctly answered all six questions (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999). Scores were then transformed into percentages of success. Internal consistency measured via Cronbach's α was .65. A second coder scored 25% of the protocols and interrater reliability was excellent, Cohen's $k = .93$.

MST: Describe-a-friend task

Participants were asked to describe their best friend (Meins et al., 2014, 2006) within a maximum of 5 minutes. Stories were audio recorded and subsequently transcribed. Narratives were coded for the frequency of MST used (see Lecce et al., 2010 for more details). Subsequent repetitions of the same mental state term (i.e., "She thinks and re-thinks..."), utterances that did not connote a genuine mental state but rather had a conversational function (i.e., "Do you know what?"), and comments that were extraneous to the description of the best friend (i.e., "I don't know what else to say") were excluded. We also computed a total-words score by summing all words used, to control for individual differences in verbosity. The adjusted index of MST was computed according to the following formula (Rosso, Viterbori, & Scopesi, 2015):

$$\text{MST adjusted index} = \frac{\text{N mental state term}}{\sqrt{\text{N total word}}}$$

Inter-rater agreement on the 25% of descriptions was good, $k = .75$.

Furthermore, because this is the first study that used this task with older adults, we were also interested in analysing the descriptions of the best friend from a qualitative point of view. For this reason, we first classified descriptions in terms of emotional valence, distinguishing between positive (reflecting an overall satisfaction with the friendship), negative (presenting the friendship as not as good as desired) and neutral (without a clear emotional connotation). Inter-rated agreement on the emotional valence of the descriptions on the 25% of the transcriptions was good, $k = .70$.

Thereafter we coded transcripts for the typology of attributes adapting the scoring procedure of Meins and colleagues (Meins & Fernyhough, 2010), which classifies each friend's attribute into one of six exclusive categories: (a) Mental: references to the mental life and intellect; (b) Behavioural: comments about activities; (c) Physical: references to any physical characteristics; (d) Self-Referential: comments in which the primary reference was

self-focused; (e) Mental relationship: references to mental states existing within the relationship; (f) Behavioural relationship: comments focused on activities shared with the friend; and (g) Other: miscellaneous attributes of the friend. Inter-rater reliability on the 25% of transcripts was good, $k = .76$.

Social relationships: Lubben Social Network Scale

The Lubben scale (Lubben & Gironda, 2003) investigates both the size and the frequency of contacts, and the perceived quality of the relationships, separately for family relationships and friendships (6 items each). Answers were rated on a 6-point Likert-type scale, ranging from 0 (*none/never*) to 5 (*nine or more/always*). Following the manual criteria, two scores were calculated, one for family and the other for friends, each one ranging from 0 to 30.

Cognitive functioning

Crystallised ability. We used the Vocabulary subscale of the Primary Mental Ability test (Thurstone & Thurstone, 1963). It consists of 50 items requesting participants to find, from among five choices provided, the correct synonym of a given word. The subject had 8 minutes to complete the task. One point was given for each correctly identified synonym (range 0-50).

Short-term and working memory. We used the Digit Span task (WAIS-R -Wechsler, 1981), both Forward, measuring short-term memory, and Backward, measuring working memory. In Forward Digit Span the subjects had to repeat the numbers listened in the same order as they heard them in the presentation. In Backward Digit Span, the subjects had to repeat numbers in the reversed order to that which they heard. The range of scores was from 3 to 9 for the Forward task and from 2 to 8 for the Backward task.

Verbal fluency. We used the Animal Naming test (Spreen & Benton, 1977). This task requested participants to name as many members of the category "animal" as possible within 60 seconds. One point was given for each animal named (repetition was not allowed).

Procedure

Participants were tested individually in two separate sessions with a one-week interval. Testing was carried out in a quiet room of the aggregation centres. In the first test session, participants filled a demographic questionnaire and were administered the MMSE, followed by the Faux Pas and the "Describe-a-friend" task. In the second test session participants completed the cognitive functioning measures and filled in the social relationships questionnaire. The order of the tasks was randomized within each session. The written consent of the participants was collected prior to the testing. The study was approved by the Ethics Committee of the Department of Brain and Behavioural Science at the University of Pavia.

Statistical Analyses

Data analyses were performed with the software IBM SPSS 19 (IBM Corp. Released, 2010). First, we briefly presented some qualitative analyses about the Describe-a-friend task. Then, we performed correlation analyses between control (cognitive functioning) and focus (MST, ToM ability and social relationships) variables. As distributions were mostly non-normally distributed, we used non-parametric statistics (Spearman's rho, r_s). Confidence intervals at 95% were calculated with bootstrapping ($n = 5000$). To correct for multiple comparisons, we used the B-H procedure (Benjamini & Hochberg, 1995), which controls the false discovery rate (FDR- i.e., the proportion of significant results that are actually false positives). FDR was set to $q = .05$, as in previous studies (e.g., LeBlanc et al., 2016; Lindquist & Mejia, 2015). Correlation coefficients comparison analyses were performed with the cocor online tool

(Diedenhofen & Musch, 2015). Finally, we examined potential predictors of social relationships through hierarchical multiple regression analyses. Multicollinearity was checked by computing VIF and tolerance statistics (Field, 2009). We inspected standardized residuals and computed DfBeta to identify potential outliers with high influences on model estimation (J. Cohen, Cohen, West, & Aiken, 2003; Field, 2009). Given the small sample size, we commented upon our results taking into consideration not only the p value, but also the effect sizes. In doing so, we adopted Cohen's guidelines in interpreting effect size (J. Cohen, 1988): $.01 < \eta_p^2 < .05$ small effect, $.06 < \eta_p^2 < .13$ medium effect and $\eta_p^2 \geq .14$ large effect; $.10 < r < .29$ small effect, $.30 < r < .49$ medium effect, $r \geq .50$ large effect; $.02 < f^2 < .14$ small effect, $.15 < f^2 < .34$ medium effect, $f^2 \geq .35$ large effect.

Results

Preliminary Analyses on the Describe-a-friend task

Preliminary qualitative analyses and examples of descriptions are reported in more detail in the Supplementary Material section. These analyses showed that, first, participants greatly differed in the length of the descriptions, using from 35 to 681 words, $M = 327.38$, $SD = 160.05$, $Mdn = 301.00$. Given this variety, it is important to acknowledge that all participants used MST at least once in their description, with cognitive and emotion states terms being more frequent than desire terms. Second, these analyses showed that the majority of the participants gave a positive description of the friendship (i.e., "He gave you peace, he always had something nice to say…"). Notably, the emotional valence did not impact on the frequency of MST. That is, there were no differences in MST between people who described the friend positively, neutrally or negatively, $F(2, 69) = 1.30$, $p = .280$, $\eta_p^2 = .04$ (see Supplementary Material for examples). Third, examining the typology of attributes used in the descriptions (Meins & Fernyhough, 2010) we found wide inter-individual variability. As

expected, MST and Mental category were associated with a medium effect size, $r_s(70) = .38$, $p = .001$, 95% CI [.161, .578]. Lastly, we examined potential gender differences through univariate ANOVAs. Results showed medium gender effects, with women showing higher MST, $F(1, 70) = 7.30$, $p = .009$, $\eta_p^2 = .09$, and specifically using more emotion terms, $F(1, 70) = 4.59$, $p = .036$, $\eta_p^2 = .06$. No other gender-related differences emerged.

Globally, qualitative analyses revealed considerable individual differences in both general features of the friend description and in MST frequency.

Preliminary Analyses on the Describe-a-friend task

Preliminary analyses showed that participants greatly differed in the length of the descriptions (range 35 - 681 words, $M = 327.38$, $SD = 160.05$, $Mdn = 301.00$). Notably, all participants used MST at least once. For cognitive state terms, the total number of references was 416 (i.e., sum of references of all participants); the most frequently used terms were "conoscere" (to know), 16%, "pensare" (to think), 12%, and "sapere" (to understand), 9%. For emotion state terms, the total number of references was 422; the most frequently used terms were "piacere" (to like), 7%, "affetto" (affection), 4%, and "amare" (to love), 3%. For desire state terms, the total number of references was 94; the most frequently used terms were "volere" (to want), 45%, "avere bisogno" (to need), 25%, and "accettare" (to accept), 6%. The Wilcoxon matched pairs signed-ranks tests indicated that whereas there was no significant difference between cognitive and emotion terms, desire terms were the least used category, zs $\geq$ -6.96, ps < .001; cognitive: $Mdn = .30$, emotion: $Mdn = .33$, desire: $Mdn = .05$.

These analyses showed that the majority of the participants (69%) gave a positive description of the friendship (i.e., "He gave you peace, he always had something nice to say…"). The 25% of the participants described the friend in a neutral way, with an "objective" attitude in the presentation of the friend (i.e, "My friend is seven years younger

than me, but our children are the same age and went to the same school, thus we experienced together all the phases of our children's lives…). The final 6% of the sample gave a description of the best friend that included some negative aspects and complained about the friendship (i.e., "[...] we were friends, then we lost contact, but we are now back in touch. We do have some things in common […] she never confides in me, [...] she keeps everything to herself…". Notably, the emotional valence did not impact on the frequency of MST. That is, there were no differences in MST between people who described the friend positively, neutrally or negatively, $F(2, 69) = 1.30$, $p = .280$, $\eta_p^2 = .04$. Third, we examined the typology of attributes used in the descriptions (Meins & Fernyhough, 2010). The total number of attributes given ranged from 7 to 52, $M = 23.63$, $SD = 10.84$. We adjusted the scores for each category, expressing them as proportions of the total number of attributes. The most common category of attribute was the Behavioural relationship (25.6%), followed by Mental (21.4%), Behavioural (15.3%), Physical (11.4%), Other (10.4%), Self-Referential (8.9%) and Mental relationship (7.0%). Notably, there was sizable individual variability, as showed by actual ranges: Behavioural relationship and Mental: 0-75%; Behavioural: 0-45.5%; Physical: 0-46.4%; Other: 0-27.7%; Self-Referential: 0-42.1%; and Mental relationship: 0-52.4%. As expected, MST and Mental category were associated with a medium effect size, $r_s(70) = .38$, $p = .001$, 95% CI [.161, .578]. Lastly, we examined potential gender differences through univariate ANOVAs. Results showed medium gender effects, with women showing higher MST, $F(1, 70) = 7.30$, $p = .009$, $\eta_p^2 = .09$, and specifically using more emotion terms, $F(1, 70) = 4.59$, $p = .036$, $\eta_p^2 = .06$. No other gender-related differences emerged. Globally, qualitative analyses revealed considerable individual differences in both general features of the friend description and in MST frequency.

Table 1 presents means scores on ToM ability, MST, social relationships, and control variables. Table 2 presents correlations between variables. Concerning control variables, age

was negatively associated with verbal fluency $r_s(70) = -.36$, $p = .002$, 95% CI [-.555, -.147], with the effect size being medium. Moreover, crystallized ability was associated with the other control variables, namely education, short term memory, working memory and fluency, $.29 \leq r_s(70) \leq .42$, $.013 \leq ps < .001$, all 95% CIs did not contain zero, the wider being [.131, .580]. The size of these effects was between medium and large. Finally, short term memory and working memory correlated with one another with a medium strength, $r_s(70) = .39$, $p = .001$, 95% CI [.164, .587] .

Concerning social relationships, even if family relationships and friendships were moderately interrelated, $r_s(70) = .37$, $p = 001$, 95% CI [.142, .566], they showed different cognitive correlates. Indeed, individual differences in relationships with family members were related to crystallized ability, $r_s(70) = .30$, $p = .011$, 95% CI [.052, .517]; please note that the associations with working memory and verbal fluency were additionally almost medium in size effect, although not significant, $r_s(70) = .28$, 95% CI [.049, .495] and $r_s(70) = .26$, 95% CI [.035, .488], respectively. On the contrary, individual differences in friendships were moderately associated with short-term memory, $r_s(70) = .32$, $p = .006$, 95% CI [.086, .533].

With explicit reference to the main aim of the present study, the association between ToM ability and MST was small in size and not significant, $r_s(70) = .18$, $p = 124$, 95% CI [-.039, .398]. Nevertheless, both ToM ability and MST showed moderate positive associations with verbal fluency, $r_s(70) = .34$, $p = .004$, 95% CI [.124, .523], and $r_s(70) = .29$, $p = .013$, 95% CI [.050, .506], respectively. Furthermore, while ToM ability was moderately related to crystallized ability, $r_s(70) = .39$, $p = .001$, 95% CI [.158, .590], MST was not related to the other control variables, all $r_ss(70) \leq .18$, $ps \geq .062$.

Crucially, MST, but not ToM ability, was correlated with friendships with a medium effect size, $r_s(70) = .33$, $p = .005$, 95% CI [.096, .527]. We further tested whether the

correlation between friendships and the two ToM measures differed from each other. Given our a priori hypothesis, namely that MST is closer to social relationships than ToM ability, we used a one-tailed test. Results indicated that the strength of the associations between MST and friendships was higher than the strength of the associations between ToM ability and friendships, $z = 1.83$, $p = .034$. The relation between ToM ability/MST and family relationships was very small in size and not significant, r_ss$(70) \leq .12$, ps $\geq .310$. This result partly supported our original hypothesis that one's relationship with friends, but not with relatives, is associated with mental states understanding.

Given that men and women differed for the frequency of MST used, and women reported more friendships than men, $F(1, 70) = 5.03$, $p = .028$, $\eta_p^2 = .07$, we examined the correlation between MST and friendships separately for men and women. The results showed that the correlation coefficients for women and men did not significantly differ, women's $r_s(54) = .25$, men's $r_s(14) = .34$, $z = .032$, $p = .747$. Therefore, participants were considered as a whole in the following analyses.

[Tables 1 and 2 near here]

Hierarchical Multiple Regression Analyses

To gain a more complete picture of the patterns of association between MST and friendships, we conducted a hierarchical regression analysis, with friendships as the dependent variable. We entered variables which showed moderate associations to friendship or MST at the first step, namely short-term memory, verbal fluency, and relationships with family. MST was entered at the second step. Preliminary diagnostic analyses indicated that the average VIF (variance inflation factors) was 1.11, and tolerance ranged from .848 to .933, thus we concluded that the regression model was not biased by multicollinearity. Additionally, no case had a standardized residual greater than 3, and no DFBeta value was greater than 1

(absolute value). Results are reported in Table 3. At Step 1 the overall equation was significant, $F(3, 68) = 4.33$, $p = .008$ and explained the 16% of the variance in friendship, Cohen's $f^2 = .19$ which is a medium effect size. Two significant predictors emerged, namely family relationships and short-term memory. More interesting, the final model was also significant, $F(4, 67) = 5.69$, $p = .001$, and explained the 25% of the variance in friendship, Cohen's $f^2 = .34$, which represent a large effect size. Notably, entering MST significantly increased the amount of variance explained, $\Delta R^2 = .09$, $F(1, 67) = 8.37$, $p = .005$. The inspection of beta coefficients revealed that this variable independently predicted friendships, over and above the significant effect of family relationships and short-term memory. To better elucidate a single predictor's role in explaining friendships, we computed local effect size following Selya and colleagues indications (Selya, Rose, Dierker, Hedeker, & Mermelstein, 2012). We found that MST showed a small but robust effect size, Cohen's $f^2 = .13$, greater than those of both family relationships and short term memory, both Cohen's f^2s = .08. Please note that results were unchanged when we entered gender at Step 1 together with the other variables, and when we excluded participants describing a deceased/past friend ($n = 8$).

[Table 3 near here]

Finally, we investigated potential predictors of relationships with family members. Based on previous correlation analyses, we entered crystallized knowledge and friendships in a single step. Preliminary diagnostic analyses indicated that the regression model was not biased by multicollinearity (average VIF = 1.00, tolerance = .99). A single case showed a standardized residual greater than 3, while all DFBeta values were lower than 1. We ran analyses with and without the identified influential case and found the same pattern of results. Thus, below we reported the analysis with all participants. Results indicated that the model

was significant, $F(2, 69) = 4.14$, $p = .016$, and explained the 11% of variance in family relationships, showing a small but not trivial effect size, Cohen's $f^2 = .13$. Notably, only friendships predicted relationships with family members, Cohen's $f^2 = .11$.

Discussion

This is the first study that examined the propensity to use ToM in a sample of older adults. In order to do that we administered the Describe-a-friend task (Meins et al., 2006) and coded it for the frequency of MST.

Our results show that the majority of participants described a current friend of the same gender and gave a positive description of the friendship. This result, on the one hand, reflects the positive emotional climate of relationships between best friends (Fuller-Iglesias, Webster, & Antonucci, 2013), and, on the other hand, may indicate older adults' preference for positive memories (Dijkstra & Kaup, 2005), in line with the socio-emotional selectivity theory (Carstensen, Fung, & Charles, 2003).

A qualitative comparison indicated that older people used a percentage of mental descriptions (21.4%) which was lower than that reported by adults (Meins et al., 2008, 25%; Szpak & Białecka-Pikul, 2015, 27%). This data, we believe, is interesting as it may reflect an age-related change in the propensity to use MST in describing social partners.

Crucially, ours is the first study that investigated older adults' MST in relation to a classic ToM task. Results indicated that there is an important gap between ToM ability and the spontaneous use of it (i.e., frequency of MST). This result fits with existing data showing a small effect size of the association between ToM ability and MST in older children (Meins et al., 2006) and adults (Apperly, 2012; Barreto et al., 2016; Rosso et al., 2015). It is also consistent with the view that ToM ability and its spontaneous use are distinct constructs and that having a high level of ToM, as emerges from a high score on an experimental ToM task, does not necessarily imply a propensity to employ such ability (Devine & Hughes, 2017). As

suggested by Meins and colleagues a possibility is that whereas scores on ToM tasks may reflect a more cognitive competence, the frequency of MST could be better conceptualised as a personal propensity to use mental state understanding ability in social relationships (Meins et al., 2014).

The other aim of the study was to test whether social relationships with friends and family members were equally associated with ToM ability and MST. The first important finding is that relationships with friends and family members showed different cognitive and socio-cognitive correlates. This fits with the fact that relationships with friends and family differ on a number of fronts. Indeed, contrary to family relationships, friendships are optional in nature and may support the feelings of autonomy; moreover, friends may provide emotional intimacy and companionship, integration into the community and broader society, and re-affirmation of self-worth (Adams & Blieszner, 1995; Antonucci & Akiyama, 1995). Crucially, our data showed that whereas the effect size of the association between relationships with family members and both ToM ability and MST was small, the effect size of the association between relationships with friends and MST was moderate. In addition, our findings showed that MST had a small but robust effect on friendships, over and above the effect of age, general cognitive functioning and family relationships. Here, it is also important to acknowledge that our model explained the 25% of variance in friendships, thus leaving unexplained a substantial part of variance. This is not surprising, given that other variables, not considered in the present study, are likely to affect relationships with friends, such as personality traits and beliefs about aging (Heyl & Schmitt, 2007; Menkin, Robles, Gruenewald, Tanner, & Seeman, 2016). Future studies should consider these and other potential predictors of friendships in aging to better elucidate which are the key factors explaining older adults' successful relationships with friends. Similar conclusions can be drawn for family relationships that are only partially explained by friendships.

The fact that friendships, but not family relationships, were associated with MST can be explained by taking into account the nature of these two social relationships: to maintain relationships with friends is more complex and requires one to use one's social skills to a greater extent than those required with regards to relationships with relatives (Roberts & Dunbar, 2011). Indeed, within family relationships there is less need to use one's social skills, because these relationships have a strong normative component and are at a lower risk of breaking (Litwak, 1981). This, at least in theory, should motivate people to put into use all the resources they have, including ToM, to maintain those relationships which are more at risk.

Interestingly, in the present study the effect size of the association between the frequency of MST and friendships was moderate in magnitude, whereas the corresponding association for the Faux Pas task was very small. This is intriguing given that MST can be conceptualized as a measure of the spontaneous use of ToM, whereas the Faux Pas task is an index of ToM ability. In other words, what makes the difference in terms of social relationships, especially with friends, is not what a person can do on a test of mental state understanding, but how much mental states understanding a person is willing to use.

One could argue that the reason for the association between MST when describing a friend and friendship (but not family relationships) is driven by the fact that both these measures refer to the same relationship (friendships). Hence, one could worry with respect to the possibility of a conceptual overlapping between these two variables. We acknowledge that this issue should be carefully considered in future studies. However, it is also important to highlight that the propensity to use MST in close relationships seems to be a stable individual characteristic, independent of more general variables such as age and language ability (Meins et al., 2006).

Our study has a number of limitations that coincide with directions for further research. First, the sample size is small, and the statistical power is low. The effects we found were only modest in magnitude and therefore larger samples, balanced in gender, are needed to confirm our results. Second, we considered our participants as belonging to a single age group. Although this choice was theoretically driven (see the Introduction), it would be interesting to investigate the age-related changes in MST in more depth by involving young, young-old and old-old participants. Finally, we used off-line tasks. Future research should investigate MST using an interactional task, thus focusing on older adults' conversations with social partners. In doing so, it could be interesting to consider other kinds of social relationships, such as a romantic partner and offspring, as compared to less close social partners, such as neighbours, or even strangers.

Overall, we believe that our study makes an important contribution to the research on older adults' ToM. Indeed, it is the first to investigate the relationships between ToM ability and the propensity to use it in normal aging, thus opening new avenues for assessing ToM in a more ecological way.

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Table 1. Means (and standard deviations), actual range, and possible range of variables investigated.

	M (*SD*)	*Actual Range*	*Possible Range*
ToM ability	43.06 (26.76)	0-100	0-100
MST	0.72 (0.29)	0.06-1.25	-
Family relationships	19.64 (5.09)	2-28	0-30
Friendships	17.51 (4.58)	5-29	0-30
Crystallized ability	44.79 (4.99)	28-50	0-50
Short term memory	5.89 (0.83)	3-8	3-9
Working memory	4.28 (1.15)	2-8	2-8
Verbal fluency	22.04 (5.18)	10-33	-

Table 2. Correlations (Spearman's rho, r_s) between variables investigated.

	1	2	3	4	5	6	7	8	9
1. ToM ability	-								
2. MST	.18	-							
3. Family relationships	.06	.12	-						
4. Friendships	.06	.33**	.37**	-					
5. Age	-.01	-.13	-.12	.21	-				
6. Education	.22	-.04	.08	.04	-.14	-			
7. Crystallized ability	.39**	.12	.30*	.12	-.22	.37** [a]	-		
8. Short term memory	.07	.10	.21	.32**	-.09	.06	.29*	-	
9. Working memory	.18	.22	.28	.18	-.16	.21	.37**	.39**	-
10. Verbal fluency	.34**	.29*	.26	.15	-.36**	.22	.42***	.26	.18

*Note. * p < .05, ** p < .01, *** p < .001.*

Table 3. Results of the regression analysis predicting friendships.

	B	*SE*	β	95% CI	*R*^{2}
Step 1					.16**
Short-term memory	1.39	0.63	.25*	[0.16, 2.69]	
Verbal fluency	-0.02	0.12	-.027	[-0.26, 0.22]	
Family relationships	0.25	0.08	.28**	[0.09, 0.43]	
Step 2					.25**
Short-term memory	1.41	0.61	.26*	[0.20, 2.62]	
Verbal fluency	-0.10	0.11	-.11	[-0.30, 0.12]	
Family relationships	0.22	0.09	.25*	[0.05, 0.40]	
MST	5.14	1.06	.32**	[1.85, 8.15]	

Note. * $p < .05$, ** $p < .01$.