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EMPATHIC ACCURACY FOR HAPPINESS

Empathic Accuracy for Happiness in the Daily Lives of Older Couples:

Fluid Cognitive Performance Predicts Pattern Accuracy among Men

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Abstract

Correctly identifying other's emotional states is a central cognitive component of empathy. We examined the role of fluid cognitive performance for empathic accuracy for happiness in the daily lives of 86 older couples (*mean* relationship length = 45 years; *mean* age = 75 years) on up to 42 occasions over seven consecutive days. Men performing better on the Digit Symbol test were more accurate in identifying ups and downs of their partner's happiness. A similar association was not found for women. We discuss the potential role of fluid cognitive performance and other individual, partner, and situation characteristics for empathic accuracy.

Keywords: empathic accuracy; older couples; daily diary; happiness; cognitive aging

Empathic Accuracy for Happiness in the Daily Lives of Older Couples: Fluid Cognitive Performance Predicts Pattern Accuracy among Men

Correctly judging other people's affective states (i.e., *empathic accuracy*) is a key element of empathic competencies (Ickes, 1997) that draws on cognitive abilities (Preston & de Waal, 2002). Yet, the cognitive correlates of everyday empathic accuracy are not well understood. This study examined associations between empathic accuracy for partners' happiness and fluid cognitive performance using up to 42 simultaneous daily life assessments from 86 old and very old couples.

The Role of Cognitive Performance for Empathic Accuracy

There are substantial individual differences in empathic accuracy in daily life (Howland & Rafaeli, 2010; Rauers, Blanke, & Riediger, 2013; Wilhelm & Perrez, 2014). Following Howland & Rafaeli (2010), three components of daily empathic accuracy can be differentiated: *level*, *scatter*, and *pattern* accuracy. *Level accuracy* refers to the absolute difference between perceived affective states by rater and target. *Scatter accuracy* indicates the extent to which raters are able to perceive how variable the target's affective states were over a certain time period. *Pattern accuracy* refers to the accuracy in perceiving ups and downs of target's affective states. A person high in pattern accuracy would perceive his or her partner as happier than usual when the partner actually reports being happier than usual.

In most theoretical frameworks of empathy, perspective taking (i.e., thinking from others' point of view) and mentalizing (i.e., understanding others' mental states) are considered central cognitive processes involved in empathic judgments (e.g., Decety & Jackson, 2004; Decety & Lamm, 2006; Hooker, Verosky, Germine, Knight, & D'Esposito, 2008; Preston & de Waal, 2002), which draw on fluid cognitive abilities, i.e., basic cognitive skills that are relatively knowledge-free (e.g., Huepe & Salas, 2013; Rakoczy, Harder-Kasten, & Sturm, 2012). It has been argued that age-related cognitive decline (particularly in fluid cognition) could be one potential factor underlying eventual age differences in empathy (Ruffman, Henry, Livingstone, & Phillips. 2008). Consistent with these notions, empathic skills have received considerable attention in the aging literature because empirical evidence

points toward decline in at least some components of empathy, including recognizing emotion in others (e.g., Grühn, Rebucal, Diehl, Luhmley, & Labouvie-Vief, 2008; Richter & Kunzmann, 2011). Furthermore, self-reported empathy has also been associated with fluid cognition (Grühn et al., 2008). Hence, fluid cognition may contribute to individual differences in empathic accuracy in daily life. Evidence on links between empathic accuracy and cognitive performance is based on laboratory studies that operationally defined empathic accuracy as inferring other's thoughts and feelings from videotaped interactions (agreement typically judged by independent raters, see Ickes & Hodges, 2013). Previous findings are inconclusive: Some studies found that cognitive performance or related constructs (e.g., grade point average [GPA] or education) predicted empathic accuracy (Ickes, Stinson, Bissonette, & Garcia, 1990; Ponnett, Buysse, Roeyers, & de Clercq, 2008; Wieck & Kunzmann, 2015), with others observing this effect only among men (Ickes et al., 2000; Thomas, Fletcher, & Lange, 1997), and one study failing to find any effect (Ponnet, Buysse, Roeyers, de Clercq, & van der Heyden, 2004). To our knowledge, no previous study examined whether individual differences in cognitive performance are associated with individual differences in empathic accuracy in daily life.

The Present Study

We examined associations between fluid cognitive performance and empathic accuracy for partner's happiness in the daily lives of older couples. We focused on happiness because older adults typically show more variation in positive than in negative affect (Röcke, Li, & Smith, 2009). We hypothesized that fluid cognitive performance would be related to empathic accuracy for partner's happiness and explored whether associations differed across indicators of level, scatter, and pattern accuracy. Given that empathic accuracy has been related to a number of other rater, partner, and situation characteristics, including relationship satisfaction, relationship length (see Ickes & Hodges, 2013), level of education of the target (Thomas et al., 1997), raters' own emotional state (see West & Kenny, 2011), and access to perceptual cues (i.e., partner's presence; see Rauers et al., 2013), we additionally controlled for and examined how these characteristics were related to empathic accuracy for happiness [1].

Method

Participants

Participants were 110 cohabiting dyads from Berlin, Germany who volunteered for an experience sampling study of daily life of older couples. Due to changes in the protocol (n = 12 couples who were not given the cognitive measures), missing data (n = 10 couples where study variables were missing for one or both partners) technical problems (n = 1), and insufficient occasions (n = 1 couple where one partner only contributed 24 of 42 possible ambulatory assessments), the final analysis sample included 86 couples (married = 84, cohabiting heterosexual = 1, homosexual civil union = 1; age: M = 75.0, SD = 3.79, *range* = 67-94; years of education: M = 14.24, SD = 2.97, *range* = 9 to 18). The analysis sample participants provided M = 41.7 out of 42 possible observations on average (SD = 0.65; *range* = 38 to 42) and performed higher than excluded participants on the test of fluid cognitive performance (p = 0.026), but did not differ on other variables.

Procedure

For 7 study days, participants completed six short questionnaires on an iPad with the app iDialogPad (G. Mutz, Cologne, Germany); immediately after waking, and at five set times throughout the day (10 AM, 1 PM, 4 PM, 7 PM, 9 PM; with times adjusted to accommodate participant's schedules).

Measures

Descriptive statistics can be found in *Supplementary Table 1*.

Perceived happiness. Participants' perception of their partner's happiness was assessed six times per day as response to the item "How happy is your partner at the moment?" on a slider-type scale with anchors at 0 (not at all) and 100 (very).

Self-reported happiness. Self-reported happiness was assessed six times per day as response to the item "How happy are you at the moment?" on a slider-type scale with anchors at 0 (not at all) and 100 (very). Self reported happiness scores were split into "state" and "trait" components (see Bolger & Laurenceau, 2013). The between-person component (*rater happiness* BP_i and *target happiness* BP_i) was defined as the person-specific average of

repeated measures, and the within-person component *rater happiness* WP_{ti} and *target happiness* WP_{ti}) was defined as occasion-specific deviations from those averages (for an illustration, see *Supplementary Figure 1*. As a control for target's overall variability, we also calculated the intraindividual standard deviation for each person (*iSD target happiness*$_i$).

Fluid cognitive performance. *Fluid cognitive performance* was measured at the end of the experience sampling protocol with the Digit Symbol test (Wechsler, 1955), a well established and reliable measure of perceptual speed among older adults (Hoyer, Stawski, Wasylyshyn, & Verhaeghen, 2004; Lindenberger, Mayr, & Kliegel, 1993, Tucker-Drob, Briley, Starr, & Deary, 2014).

Other covariates. *Gender* was a dichotomous variable (0 = men; 1 = women). *Relationship satisfaction* was measured as response to the item "All in all, how would you rate your current relationship?" on a 5-point scale (0 = "very bad" to 4 = "very good")[2]. *Relationship length* indicated the number of years participants were married, in a civil union, or in a relationship (the cohabiting couple). *Partner's presence* was reported at each occasion (0 = no; 1 = yes).

Data analysis

Following Howland & Rafaeli (2010), we differentiated between level, scatter, and pattern accuracy. *Level accuracy* for happiness was measured at each occasion as the absolute difference between perceived happiness by the rater and target's self-reported happiness and averaged across all available occasions (higher values indicate less accuracy). *Scatter accuracy* for happiness was measured as the proportion of the intraindividual standard deviation of each rater's perceived partner happiness to the intraindividual standard deviation of target's self-reported happiness. Log-transformed to achieve a better distribution, scores = 0 indicate perfect scatter accuracy, scores < 0 indicate underestimation, scores > 0 indicate overestimation (Howland & Rafaeli, 2010). *Pattern accuracy* for happiness was measured and examined within a multilevel model for distinguishable dyads (see Bolger & Laurenceau, 2013, chapter 8), withgender used as the distinguishing variable[3] in line with previous

research on empathic accuracy in couples (Rauers et al., 2013; Wilhelm & Perrez, 2004). Dyadic models were specified for women (subscript *w*) and men (subscript *m*) as,

$$\textit{Perceived happiness by rater}_{tiw} = \beta_{0iw} + \beta_{1iw}\,(\textit{target happiness WP}_{tiw}) + \beta_{2iw}\,(\textit{rater happiness WP}_{tiw}) + \beta_{3iw}\,(\textit{target happiness WP}_{tiw} \times \textit{rater happiness WP}_{tiw}) + \beta_{4iw}\,(\textit{partner's presence}_{tiw}) + \beta_{5iw}\,(\textit{target happiness WP}_{tiw} \times \textit{partner's presence WP}_{tiw}) + e_{tiw}, \quad (1)$$

$$\textit{Perceived happiness by rater}_{tim} = \beta_{0im} + \beta_{1im}\,(\textit{target happiness WP}_{tim}) + \beta_{2im}\,(\textit{rater happiness WP}_{tim}) + \beta_{3im}\,(\textit{target happiness WP}_{tim} \times \textit{rater happiness WP}_{tim}) + \beta_{4im}\,(\textit{partner's presence}_{tim}) + \beta_{5im}\,(\textit{target happiness WP}_{tim} \times \textit{partner's presence WP}_{tim}) + e_{tim}, \quad (2)$$

where *perceived happiness by rater*$_{ti}$ of target person *i*'s happiness at time *t* is a function of a person-specific intercept coefficient, β_{0i}, and person-specific coefficients, β_{1i} that indicates the extent to which the rater's perceptions correspond with the target person's self-reported happiness (i.e., empathic pattern accuracy for happiness), β_{2i} that characterizes the extent to which the rater's perceptions of target happiness correspond with his or her own happiness at the same occasion, β_{3i} that indicates whether raters are more accurate when they are happier than usual, β_{4i} that indicates whether ratings of partner's happiness are higher at times when he or she is present, β_{5i} that indicates whether raters are more accurate when their partners are present, and residual error, e_{tj} that may be correlated within dyad and auto-correlated (AR1, Bolger & Laurenceau, 2013). Coefficients for between-person differences in intercepts (β_{0i}) and empathic pattern accuracy for happiness (β_{1i}) were modeled, for women, as

$$\beta_{0iw} = \gamma_{00w} + \gamma_{01w}\,(\textit{rater Digit Symbol score}_{iw}) + \gamma_{02w}\,(\textit{target happiness BP}_{iw}) + \gamma_{03w}\,(\textit{iSD target happiness}_{iw}) + \gamma_{04w}\,(\textit{rater happiness BP}_{iw}) + \gamma_{05w}\,(\textit{target Digit Symbol score}_{iw}) + \gamma_{06w}\,(\textit{rater relationship satisfaction}_{iw}) + \gamma_{07w}\,(\textit{target relationship satisfaction}_{iw}) + \gamma_{08w}\,(\textit{relationship length}_{iw}) + u_{0iw}, \quad (3)$$

$$\beta_{1iw} = \gamma_{10w} + \gamma_{11w}\,(\textit{rater Digit Symbol score}_{iw}) + \gamma_{12w}\,(\textit{target happiness BP}_{iw}) + \gamma_{13w}\,(\textit{iSD target happiness}_{iw}) + \gamma_{14w}\,(\textit{rater happiness BP}_{iw}) + \gamma_{15w}\,(\textit{target Digit Symbol score}_{iw}) + \gamma_{16w}\,(\textit{rater relationship satisfaction}_{iw}) + \gamma_{17w}\,(\textit{target relationship satisfaction}_{iw}) + \gamma_{18w}\,(\textit{relationship length}_{iw}) + u_{1iw}, \quad (4)$$

$$\beta_{2iw} = \gamma_{20w} + u_{2iw}, \quad (5)$$

$$\beta_{3iw} = \gamma_{30w}, \quad (6)$$

$$\beta_{4iw} = \gamma_{40w} + \gamma_{41w}\,(rater\ Digit\ Symbol\ score_{iw}), \quad (7)$$

$$\beta_{5iw} = \gamma_{50w} + \gamma_{51w}\,(rater\ Digit\ Symbol\ score_{iw}) \quad (8)$$

where γ_{00} and γ_{10} indicate level of perceived happiness and empathic pattern accuracy for happiness for the typical woman; γ_{20} and γ_{30} indicate the extent of similarity between perceived happiness of the target and own happiness and its effect on empathic pattern accuracy for the typical woman; and γ_{40} and γ_{50} indicate the effects of partner's presence on level of perceived happiness and on empathic pattern accuracy for the typical woman. The other γ parameters indicate the extent to which β parameters are related to raters' fluid cognitive performance, targets' overall happiness, and other covariates; us are residual differences that may be correlated across women, men, and dyads. Parallel equations were run for men. Equations for a baseline model without covariates are provided in Supplemental Materials. All models were estimated using SAS Proc Mixed (Littell, Miliken, Stoup, & Wolfinger, 1996) with incomplete data treated as missing at random (Little & Rubin, 1987) and predictors centered at person and/or sample means.

Results

The Role of Fluid Cognitive Performance for Empathic Accuracy for Happiness

We examined whether fluid cognitive performance was associated with level, scatter, and pattern accuracy for happiness. Correlations and regressions in *Table 1* show that performance on the Digit Symbol test was not associated with empathic level accuracy or scatter accuracy for happiness. Results from the multilevel model wherein perceived happiness was regressed on fluid cognitive performance and covariates are shown in *Table 2* (baseline model without covariates in *Supplemental Materials*, along with illustration of individual differences in empathic pattern accuracy for happiness in *Supplementary Figure 2*). Empathic pattern accuracy was indicated by the slope between perceived happiness and target's happiness (WP). Rater's Digit Symbol scores significantly predicted empathic pattern accuracy for happiness (i.e., predicted the extent of association between target's happiness

(WP) and the perceived happiness of the target) among men ($\gamma_{11m} = 0.006$, $p = 0.035$), but not among women ($\gamma_{11w} = 0.001$; $p = 0.639$). This finding is illustrated in *Figure 1*.

The Role of Individual, Partner, and Situation Characteristics

As can be obtained in *Table 1*, in a multiple regression, only perceived happiness by the rater predicted empathic level accuracy for happiness ($\beta = -0.37$, $p = 0.003$): participants who perceived their partners to be on average happier than others showed higher level accuracy for happiness. Scatter accuracy for happiness was also predicted by rater's perceived happiness, with participants who rated their partners on average as happier also rating them as less variable ($\beta = -0.31$, $p = 0.005$). Furthermore, participants with partners who were more variable in their happiness were underestimating this variability ($\beta = -0.60$, $p < 0.001$), while participants with higher relationship satisfaction underestimated less ($\beta = 0.19$, $p = 0.014$).

For empathic pattern accuracy, it can be obtained from *Table 2* that men with higher overall happiness than others showed higher empathic pattern accuracy for happiness ($\gamma_{14m} = 0.004$; $p = 0.019$). Among women, there was no such association ($\gamma_{14w} = 0.000$; $p = 0.837$). Furthermore, men showed higher levels of pattern accuracy for happiness when their partners were present ($\gamma_{50m} = 0.075$; $p = 0.014$), whereas women did not ($\gamma_{50w} = -0.006$; $p = 0.889$). Furthermore, we tested whether the Digit Symbol score was a better predictor of empathic pattern accuracy when the partner was present. This was not the case among women ($\gamma_{51w} = 0.003$; $p = 0.296$) or men ($\gamma_{51m} = 0.004$; $p = 0.388$).[4]

Although some predictors were related to empathic pattern accuracy for happiness in men but not in women (Digit Symbol test, rater's average happiness, partner's presence), gender differences in these parameters were not significant (see Supplemental Materials).

Discussion

In summary, our hypothesis that fluid cognitive performance would predict empathic accuracy was partially confirmed: Higher performance on the Digit Symbol test predicted higher empathic pattern accuracy among men. Below we discuss the main findings of our study and outline avenues for future research.

Fluid Cognitive Performance and Empathic Accuracy for Happiness in Older Adults

Our findings on fluid cognitive performance and empathic accuracy for happiness extend previous research in two ways: First, they show that fluid cognitive performance was not associated with level and scatter, but with pattern accuracy (in men), suggesting that the identification of ups and downs in partner's happiness is a judgment that may involve fluid cognitive processing. Second, our finding that the effect of fluid cognitive performance (among men) on empathic pattern accuracy for happiness was independent of partner's presence suggests that the effect was not solely based on processes related to visual or auditory perception and possibly involves higher-order cognitive processes.

Our hypothesis on the association between Digit Symbol performance and empathic pattern accuracy for happiness was not gender-specific. We found that the association was significant in men but not in women. However, post-hoc tests showed that there was no significant gender difference in the strength of this association. More research is necessary to understand why our hypothesis was not confirmed in women. Previous explanations related to gender roles, such as women being typically socialized to be sensitive toward other's feelings and thus requiring less (cognitive) effort to be empathically accurate (see Thomas et al., 1997), do not apply to our study because there was no significant gender difference.

The Role of Individual, Partner, and Situation Characteristics

Level accuracy for happiness was higher if rater's perceived happiness was higher, possibly indicating that participants were generally using the upper end of the response scale (*directional bias*, see West & Kenny, 2011). Furthermore, individuals who expected their partners to be relatively happy also expected them to be less variable, which corresponds with the finding that happier individuals are less variable in their affective states (Eid & Diener, 1999). Participants with more variable partners underestimated their partner's variability in happiness, suggesting that individuals generally expected their partners to be rather stable; being more satisfied with one's relationship was associated with less underestimation.

It has been argued that empathic accuracy for positive emotions may be important for optimizing well-being in old age (Blanke et al., 2016; Gable, Gonzaga, & Strachman, 2006; Petrican, Moscovitch, & Grady, 2014). For example, Blanke and colleagues (2016) found that

empathic accuracy for positive emotions predicted higher social adjustment. Contrary to these assumptions, relationship satisfaction (and length) are not related to empathic pattern accuracy in our study. However, we note that our participants were married/in a civil union/in a relationship for a long time (*Median* = 49 years) and showed high levels of relationship satisfaction (see Supplementary Table 1). Associations between empathic pattern accuracy and relationship satisfaction or length may emerge in couples new in their relationship. The only finding supportive of an association between empathic pattern accuracy and well-being was that men who showed higher empathic pattern accuracy for their partner's happiness were on average happier than others. As a situational characteristic, partner's presence predicted empathic pattern accuracy in men, suggesting that men partly relied on perceptual cues when judging their partner's happiness. These effects were not observed in women; however, gender differences in the strength of these effects were not significant. More research is needed to understand why the effects were not significant in women. Our study did not support that different mechanisms may be at play for women and men.

Limitations and Outlook

We note some limitations of our study to put our findings in perspective. First, our study included a convenience sample with a high level of education. It is an open question whether our findings apply to the general population. A second limitation relates to our measures. Specifically, our study lacked measures of perceived emotions other than happiness, and relationship satisfaction was assessed with a single item. Also, we used self-reported happiness by the target as the criteria to judge the accuracy of rater's perceptions. However, some affective states may not be consciously experienced (and thus not reported) by the target but picked up by the rater. This possibility is an interesting topic for future research. Similarly, fluid cognitive performance was assessed with a single task measuring perceptual speed which is related to a number of fluid abilities, including reasoning, working memory, or episodic memory and arguably reflects general brain integrity (e.g., Stawski, Sliwinski, & Hofer, 2013; Verhaeghen & Salthouse, 1997). Thus, it is not clear which cognitive abilities underlie the observed association. Furthermore, our study only assessed

between-person differences in fluid cognitive performance. Future research should examine associations between empathic accuracy and within-person variation of cognitive performance within days as to better understand cognitive mechanisms involved. A third limitation relates to our study taking place within a single week. Integrated macro- and micro-longitudinal studies (Gerstorf, Hoppmann, & Ram, 2014) will allow examining associations between cognitive changes, empathic accuracy, daily experiences, and relationship satisfaction over longer time frames.

Conclusions

The current study adds to previous work on empathic accuracy by showing that higher levels of fluid cognitive performance predict higher empathic pattern accuracy for happiness. This association was observed among men, but not among women and was independent of partner's presence, suggesting that it is not solely based on perceptual processes. Next steps include systematic search for the processes and mechanisms through which cognition may facilitate and/or hamper identifying ups and downs of other's affective states as they go about their daily lives.

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Footnotes

[1] We explored age and presence of conjoint children as predictors of empathic accuracy for happiness. Because we did not find any associations with these variables, we did not include them as covariates in subsequent analyses to reduce complexity given our small sample size. We note that variation in age was small (M = 75 years, SD = 4 years) and that the majority of our participants had conjoint children (75% of couples who provided valid data).

[2] To examine the validity of this single item, we utilized data that was obtained from a subsample of our participants in a follow-up assessment that took place approximately one year later. As part of this follow-up assessment, 137 participants included in the present study completed the Relationship Assessment Scale (RAS; Hendrick, Dicke, &, Hendrick, 1998; German version: Sander & Böcker, 1993) and 126 participants completed the Relationship Quality Inventory (QRI; Pierce, Sarason, & Sarason, 1991; German version: Reiner, Beutel, Skaletz, Brähler, & Stöbel-Richter, 2012). Our single-item measure was positively correlated both with the RAS (r = 0.67) and QRI (r = 0.57) total scores.

[3] Because gender was an inappropriate distinguishing characteristic for the one homosexual couple, both models were run twice with the two members of this dyad each placed in one or the other category. The main findings did not differ across runs.

[4] We examined whether associations between Digit Symbol test performance and empathic pattern accuracy for happiness in men were based on differences in educational attainment (see Thomas et al., 1997). To do so, we repeated our analyses reported in Table 2 with years of education as an additional correlate. In these analyses, performance in the Digit Symbol test continued to be associated with higher levels of empathic pattern accuracy for happiness, whereas education was not. Furthermore, education was not associated with level or scatter accuracy for happiness. Thomas and colleagues' (1997) study reporting an association between education and empathic accuracy in men involved younger and middle-aged couples whereas our study included older participants who have probably completed their education decades ago. Thus, it is possible that the Digit Symbol test score was a better indicator of between-person differences in cognitive function than years of education in this sample.

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Table 1

Empathic Level and Scatter Accuracy for Happiness: Correlations and Multivariate Regression Analysis

Variable (range)	Level Accuracy (Higher values = Inaccuracy)			Scatter Accuracy (0 = perfect accuracy, lower than 0 = underestimation, higher than 0 = overestimation)		
	Correlation	B (SE)	β	Correlation	B (SE)	β
Intercept		17.50* (0.56)			−0.12* (0.04)	
Perceived happiness by the rater (6 – 98)	−0.42*	−0.22* (0.07)	−0.37	−0.07	−0.01* (<0.01)	−0.31
Target's self-reported happiness (5 – 97)	−0.21*	0.00 (0.05)	0.00	0.10	0.00 (<0.01)	0.03
iSD target's self-reported happiness (4 – 37)	0.17*	0.17 (0.10)	0.13	−0.59*	−0.06* (0.01)	−0.60
Rater's self-reported happiness (5 – 97)	−0.36*	−0.03 (0.07)	−0.05	−0.08	0.01 (<0.01)	0.17
Rater's Digit Symbol score (12 – 63)	−0.12	−0.09 (0.07)	−0.10	0.01	0.00 (<0.01)	−0.04
Target's Digit Symbol score (12 – 63)	−0.10	−0.07 (0.07)	−0.08	−0.04	0.00 (<0.01)	0.00
Gender (0=men; 1=women)	−0.01	0.77 (1.25)	0.05	0.20*	0.14 (0.08)	0.12
Rater's relationship satisfaction (2 – 4)	0.00	1.76 (1.29)	0.12	0.07	0.20* (0.08)	0.19
Target's relationship satisfaction (2 – 4)	−0.07	−1.45 (1.29)	−0.10	−0.04	−0.14 (0.08)	−0.14
Relationship length (1 – 63 years)	0.10	0.03 (0.04)	0.05	0.05	0.00 (<0.01)	0.06
		R^2 = 0.23			R^2 = 0.41	

Note. N = 86 couples (172 individuals). Level accuracy is indicated by the average absolute within-dyad difference between perceived happiness by the rater and target's self-reported happiness. Higher values indicate lower level accuracy for happiness. Predictors were centered at sample means. B = Regression coefficient, SE = standard error, β = standardized regression coefficient. * $p < .05$.

Table 2.

Multilevel Model Examining Perceived Happiness (Dependent Variable) as a Function of Target's Happiness, Perceptual Speed and Covariates.

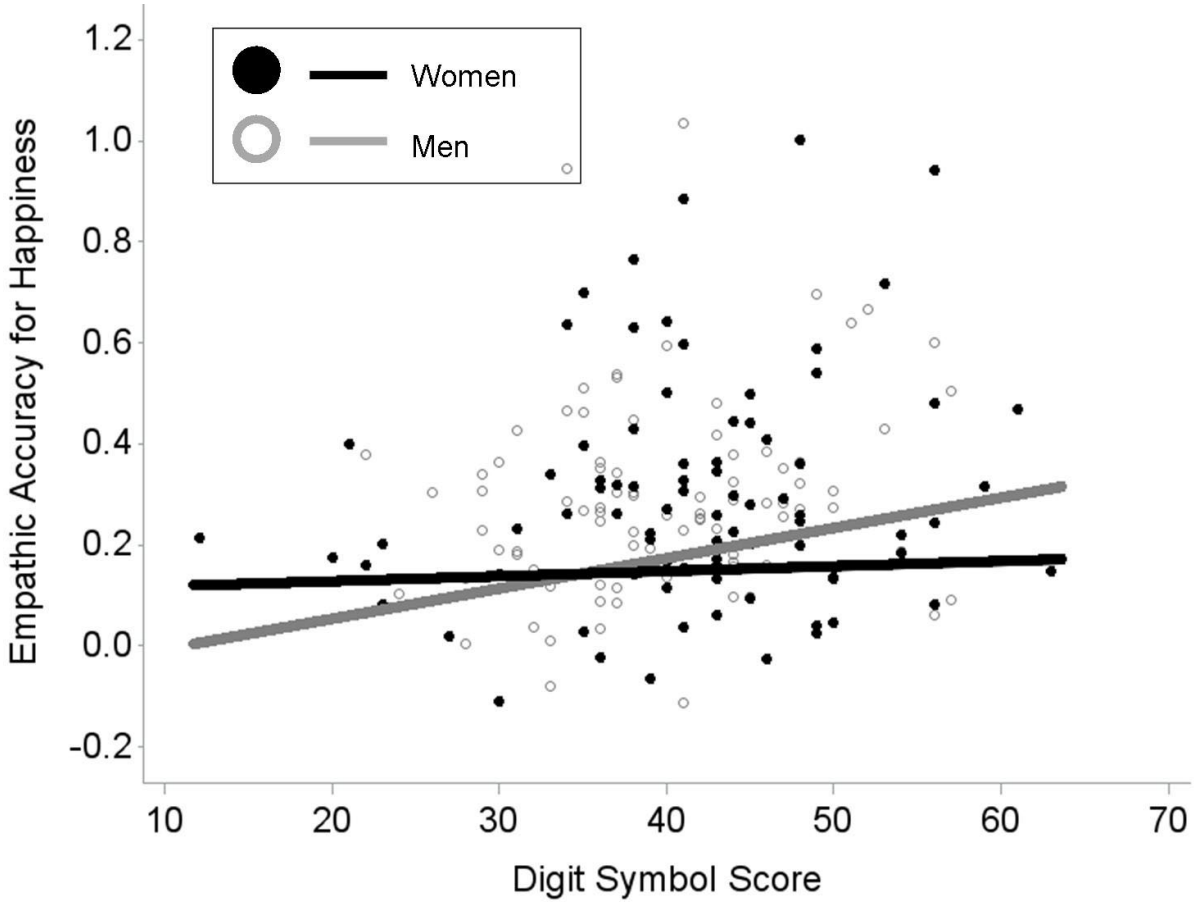
	Women	Men
Parameter	Estimate (SE)	Estimate (SE)
Fixed effects		
Intercept , γ_{00}	66.691* (0.992)	64.086* (0.923)
Target's happiness BP, γ_{02}	0.155* (0.069)	0.241* (0.061)
Target's happiness WP, γ_{10}	0. 149* (0.031)	0.178* (0.026)
iSD target's happiness, γ_{03}	−0.210 (0.161)	−0.126 (0.136)
Rater's happiness BP, γ_{04}	0.754* (0.064)	0.661* (0.063)
Rater's happiness WP, γ_{20}	0.297* (0.024)	0.324* (0.030)
Rater's DS score, γ_{01}	0.074 (0.092)	−0.200 (0.111)
Target's DS score, γ_{05}	0.010 (0.115)	−0.067 (0.088)
Rater's relationship satisfaction, γ_{06}	0.038 (1.905)	3.008 (2.004)
Target's relationship satisfaction, γ_{07}	−0.121 (2.105)	−1.500 (1.823)
Relationship length, γ_{08}	0.017 (0.067)	0.071 (0.065)
Partner's presence, γ_{40}	1.409* (0.624)	1.136* (0.564)
Partner's presence × rater's DS score, γ_{41}	−0.015 (0.061)	0.093 (0.074)
Target's happiness BP × Target's happiness WP, γ_{12}	−0.002 (0.002)	0.001 (0.002)
iSD target's happiness × Target's happiness WP, γ_{13}	−0.001 (0.006)	−0.003 (0.004)
Rater's happiness BP × Target's happiness WP, γ_{14}	0.000 (0.002)	0.004* (0.002)
Rater's happiness WP × Target's happiness WP, γ_{30}	0.000 (0.001)	−0.001 (0.001)
Rater's DS score × Target's happiness WP, γ_{11}	**0.001 (0.003)**	**0.006* (0.003)**
Target's DS score × Target's happiness WP, γ_{15}	0.002 (0.004)	0.002 (0.002)
Rater's relationship satisfaction × Target's happiness WP, γ_{16}	−0.042 (0.064)	0.062 (0.050)
Target's relationship satisfaction × Target's happiness WP, γ_{17}	0.090 (0.071)	−0.061 (0.047)
Relationship length × Target's happiness WP, γ_{18}	0.000 (0.002)	0.002 (0.002)
Partner's presence × Target's happiness WP, γ_{50}	−0.006 (0.041)	0.075* (0.030)
Rater's DS score × Partner's presence × Target's happiness WP, γ_{51}	0.004 (0.004)	0.003 (0.004)
Random effects		
Between couples		

Variance intercept, σ^2_{u0}	63.14* (10.97)	54.67* (9.57)
Variance target's happiness WP, σ^2_{u1}	0.04* (0.01)	0.02* (0.01)
Variance rater's happiness WP, σ^2_{u2}	0.03* (0.01)	0.05* (0.01)
Covariance intercept, target's happiness WP, $\sigma_{u0,\ u01}$	−0.32 (0.25)	−0.17 (0.18)
Covariance intercept, rater's happiness WP, $\sigma_{u0,\ u02}$	−0.61* (0.22)	0.46 (0.26)
Covariance target's happiness WP, rater's happiness WP, $\sigma_{u1,\ u02}$	0.01 (0.01)	−0.01 (0.01)
Covariance intercepts of women and men, $\sigma_{u0w,\ u0m}$	−3.69 (7.37)	
Covariance target's happiness WP of women and men, $\sigma_{u1w,\ u01m}$	0.01 (0.01)	
Covariance rater's happiness WP of women and men, $\sigma_{u2w,\ u2m}$	0.01 (0.01)	
Covariance women's intercept men's target happiness, $\sigma_{u0w,\ u1m}$	−0.04 (0.21)	
Covariance women's intercept men's rater happiness, $\sigma_{u0w,\ u2m}$	−0.02 (0.26)	
Covariance women's target happiness men's intercept, $\sigma_{u2w,\ u1m}$	0.16 (0.27)	
Covariance women's target and men's rater happiness, $\sigma_{u1w,\ u2m}$	0.01 (0.01)	
Covariance women's rater happiness men's intercept, $\sigma_{u2w,\ u0m}$	0.03 (0.19)	
Covariance women's rater and men's target happiness, $\sigma_{u2w,\ u1m}$	0.00 (<0.01)	
Within couples		
Residual variance, e_{ti}	160.62* (4.00)	142.57* (3.59)
Covariance women's residual men's residual, $e_{tiw,\ tim}$	6.38* (2.63)	
Autocorrelation	0.163* (0.013)	

Note. N = 86 couples (172 individuals) who provided 38 to 42 observations per participant. Unstandardized estimates and standard errors are presented. Empathic pattern accuracy is indicated by the slope between target's happiness (WP) and the perceived happiness of the target (γ_{10}). Positive parameters indicate differences favoring participants with higher rater and target happiness, better rater and target cognitive test scores, with higher levels of rater and target relationship satisfaction and couples with a longer relationship length.
* $p < .05$.

Figure Caption

Figure 1. Illustrating the association between perceptual speed and empathic pattern accuracy for happiness. Each dot represents an individual participant (black circles = women; grey circles = men). Scores for empathic pattern accuracy of happiness were obtained in a zero-order multilevel model where target's self-reported happiness was the only predictor of rater's perceptions (the estimate plotted on the y-axis is equivalent to γ_{10} in Table 2). Among men higher levels of Digit Symbol performance were associated with higher empathic pattern accuracy for happiness in daily life (grey line). Among women, the association was not significant (black line).


Women
Men
Empathic Accuracy for Happiness
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
10
20
30
40
50
60
70
Digit Symbol Score