1   Associations between cognitive and affective empathy and internalizing symptoms in late

2   childhood

3   Kate Bray[1,2], Elena Pozzi[1,4], Orli S. Schwartz[4], Nandita Vijayakumar[5], Sally Richmond[6],

4   Camille Deane[5], Nicholas B. Allen[7], Vicki Anderson[2,3], Christos Pantelis[1], & Sarah

5   Whittle[1]

6   [1] Melbourne Neuropsychiatry Centre (MNC), Department of Psychiatry, The University of

7   Melbourne & Melbourne Health, Melbourne, Australia

8   [2] Melbourne School of Psychological Sciences, University of Melbourne, Melbourne,

9   Australia

10   [3] Murdoch Children's Research Centre, Melbourne, Australia

11   [4] Orygen, Melbourne Australia, Centre for Youth Mental Health, University of Melbourne,

12   Australia

13   [5] School of Psychology, Deakin University, Melbourne, Australia

14   [6] Turner Institute for Brain and Mental Health, School of Psychological Sciences, Monash

15   University, Melbourne, Australia

16   [7] Department of Psychology, University of Oregon, USA

17   Author Note

Add complete departmental affiliations for each author here. Each new line herein must be indented, like this line.

Enter author note here.

Correspondence concerning this article should be addressed to Kate Bray, Postal address. E-mail: my@email.com

Abstract

Empathy is a multidimensional construct, which includes cognitive (i.e., understanding another's emotional state) and affective (i.e., experiencing and reacting to another's emotional state) components. Studies in adults have demonstrated that both affective and cognitive empathy are related to anxious and depressive symptoms. The aim of this study was to examine these associations in childhood, where there is relatively less research. Participants were 127 9- and 10-year-old children, recruited from the community. Self-report measures of cognitive and affective empathy, and internalizing symptoms were administered, as well as a task-based measure of cognitive empathy. Canonical correlation analysis demonstrated that components of affective empathy, specifically affective sharing and empathic distress, were associated with internalizing (particularly social anxiety) symptoms. Although empathy is important for successful social interaction, this study suggests that children who share each other's emotions strongly are more likely to experience anxiety, particularly of a social nature.

Keywords: keywords

Word count: X

Associations between cognitive and affective empathy and internalizing symptoms in late childhood

Methods

Participants

Material

Procedure

Data analysis

#We used R (Version 4.0.2; R Core Team, 2020) and the R-packages *car* (Version 3.0.8; Fox & Weisberg, 2019; Fox, Weisberg, & Price, 2020), *carData* (Version 3.0.4; Fox et al., 2020), *corx* (Version 1.0.6.1; Conigrave, 2020), *dplyr* (Version 1.0.0; Wickham, François, Henry, & Müller, 2020), *ggplot2* (Version 3.3.2; Wickham, 2016), *lubridate* (Version 1.7.9; Grolemund & Wickham, 2011), *papaja* (Version 0.1.0.9942; Aust & Barth, 2020), *plyr* (Version 1.8.6; Wickham et al., 2020; Wickham, 2011), and *psych* (Version 1.9.12.31; Revelle, 2019) for all our analyses.

Results

Canonical Correlation Analysis

Table 1

Descriptive statistics characterizing the sample used for the CCA analysis

Demographic measure	Frequency or Mean	Percentage or Stnd. Dev.
Sex		
Female	68	53.54
Male	59	46.46

Table 1 continued

Demographic measure	Frequency or Mean	Percentage or Stnd. Dev.
Age		
blank1	10	4.55
Est. FSIQ		
blank2	106	10.91
Parent Education		
Grade 7 to 12	13	10.24
Graduated High School	10	7.87
Partial tertiary university	5	3.94
TAFE	21	16.54
Bachelor's degree	29	22.83
Honors	4	3.15
Partial graduate school	9	7.09
Completed graduate school	36	28.35
Neighborhood advantage		
Quintile 1	28	22.05
Quintile 2	33	25.98
Quintile 3	30	23.62
Quintile 4	24	18.90
Quintile 5	12	9.45
Race		
White	92	72.44
Asian	14	11.02
Mixed or other	14	11.02
Missing	7	5.51
Ethnicity		
Australian (or New Zealander)	75	59.06

Table 1 continued

Demographic measure	Frequency or Mean	Percentage or Stnd. Dev.
Australian/European	17	13.39
Australian/Asian	11	8.66
Asian1	6	4.72
European	3	2.36
Other	8	6.30
Missin	7	5.51

Note. Est. FSIQ = Estimated full scale IQ, Neighborhood advantage is listed from least advantage to most

Table 2

Means, standard deviations, range, skew and kurtosis for the key measures used in the CCA

Measure of interest	N	Mean	SD	Range	Skew	Kurtosis	Cronbach's α
Empathy							
Affective Sharing	127	9.59	3.69	16.00	0.35	-0.22	0.84
Cognitive Empathy	127	13.34	2.79	16.00	-0.15	0.06	0.68
Empathic Concern	127	16.53	2.32	11.00	-0.43	-0.17	0.58
Empathic Distress	127	8.16	3.09	15.00	0.31	-0.29	0.64
Silent Films	127	7.68	2.21	11.00	-0.54	0.44	0.31
CDI (before binarization)							
Neg. mood/phys. symptoms	127	2.61	2.31	9.00	0.68	-0.42	0.62
Negative self-esteem	127	0.84	1.20	5.00	1.62	2.07	0.61
Ineffectiveness	127	2.63	2.43	10.00	0.95	0.06	0.70
Interpersonal problems	127	0.73	1.21	5.00	1.70	1.91	0.65
SCAS							
Separation anxiety	127	3.96	3.03	16.00	0.96	1.23	0.71
Social phobia	127	3.51	2.91	12.00	0.77	-0.14	0.75
Physical injury fears	127	3.65	2.59	12.00	0.72	0.15	0.75
Generalized anxiety	127	4.94	2.94	16.00	0.65	0.52	0.74
Obsessive compulsive	127	5.02	3.42	14.00	0.53	-0.21	0.52
Panic/agoraphobia	127	2.67	2.83	14.00	1.41	2.16	0.76

Table 3

Bivariate correlations for key variables and covariates (Pearson's)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Aff. Sharing	-														
2. Cog. Emp.	.31***	-													
3. Emp. Concern	.31***	.51***	-												
4. Emp. Distress	.48***	.25**	.33***	-											
5. Silent Films	-.04	.07	.03	.11	-										
6. Neg. Mood	.30***	-.09	-.01	.23**	-.02	-									
7. Neg. Self-est.	.04	-.05	.03	.10	.08	.53***	-								
8. Ineff.	.21*	-.22*	-.20*	.02	-.09	.47***	.49***	-							
9. Interpersonal	.12	-.08	-.04	.12	.03	.57***	.57***	.49***	-						
10. Sep. Anx.	.31***	-.04	.08	.21*	-.08	.46***	.30***	.37***	.36***	-					
11. Social Anx.	.42***	-.07	.04	.33***	-.04	.50***	.36***	.54***	.41***	.53***	-				
12. Phys.Injury	.26**	-.05	.04	.17	-.12	.29***	.15	.40***	.20*	.47***	.45***	-			
13. GAD	.37***	.10	.21*	.35***	-.06	.43***	.29**	.38***	.30***	.55***	.58***	.38***	-		
14. OCD	.28**	.05	.16	.19*	-.19*	.47***	.36***	.44***	.25**	.48***	.54***	.33***	.57***	-	
15. Panic/Ag.	.29***	.10	.14	.25**	-.08	.43***	.42***	.54***	.49***	.53***	.56***	.42***	.70***	.61***	-
16. Sex	.23**	.09	.10	.20*	.05	.01	.07	.00	.11	.36***	.30***	.22*	.18*	.06	.13
17. IQ	.08	.13	.15	.16	.32***	-.07	-.14	-.26**	-.06	-.08	-.06	-.01	.00	-.08	-.13

Table 3 continued

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
18. Parent Ed.	.19*	.12	.06	-.09	-.06	-.01	-.14	-.19*	-.01	.05	.03	.01	.00	-.07	-.03
19. Neighborhood	-.01	.06	.06	.05	-.13	-.20*	-.12	-.17	-.09	-.14	-.13	-.02	-.07	-.09	.02
20. Age	.10	.05	.14	.22*	.03	-.05	-.08	-.16	-.11	-.12	.01	-.10	-.05	-.05	-.15

Note. * p < 0.05; ** p < 0.01; *** p < 0.001. Not corrected for multiple comparisons. Full variable names: ineffectiveness, negative self-esteem, physical symptoms, interpersonal problems, physical injury fears, separation anxiety, social anxiety/phobia, obsessive compulsive symptoms, generalized symptoms, panic/agoraphobia, parent education, neighborhood advantage, silent films task, full scale IQ estimate, sex, cognitive empathy, empathic sharing and empathic distress.
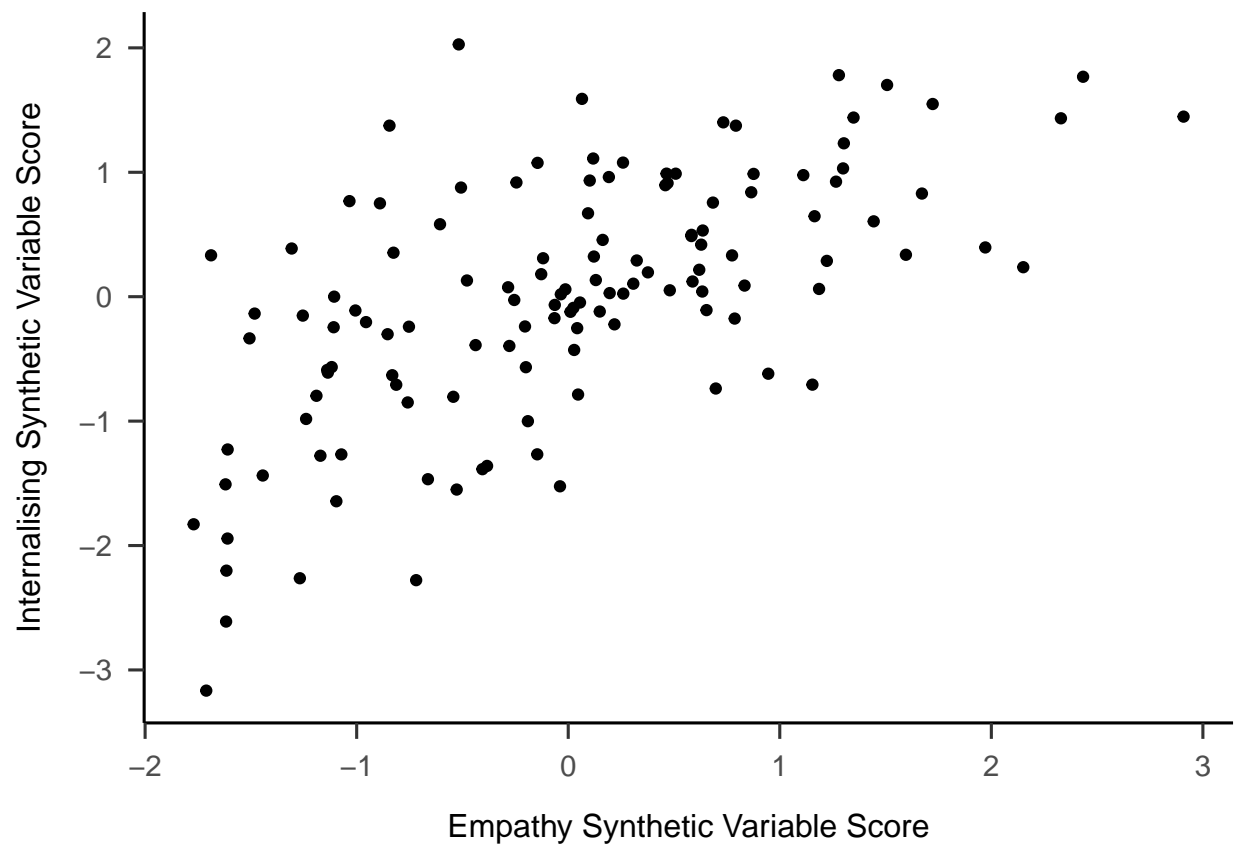
Figure 1. Scatterplot displaying the correlation between the empathy synthetic variable (linear combination of the original empathy measures and the covariates), and the internalising synthetic variable from the first function in the CCA.

Discussion

Table 4

Pertinent values from the CCA analysis for each of the nine canonical functions created

Dimension	Rc	Rc2	Wilk's Λ	Multiple F	df1	df2	Para. p-value (F)	Para. p-value (Rc)
1	0.63	0.40	0.30	1.59	90	742.75	.001	< .001
2	0.51	0.26	0.50	1.12	72	670.60	.249	< .001
3	0.38	0.15	0.68	0.78	56	597.68	.876	< .001
4	0.31	0.09	0.80	0.60	42	524.09	.978	< .001
5	0.27	0.07	0.88	0.47	30	450.00	.993	.003
6	0.16	0.03	0.95	0.28	20	375.73	.999	.071
7	0.13	0.02	0.98	0.23	12	301.91	.997	.151
8	0.08	0.01	0.99	0.14	6	230.00	.991	.352
9	0.01	0.00	1.00	NA	2	NA		.900

Note. * = <0.05, bold text = both parametric and non-parametric p-value significant. Rc = Canonical Correlation, Rc2 = Canonical Correlation Squared

References

Aust, F., & Barth, M. (2020). *papaja: Create APA manuscripts with R Markdown.* Retrieved from https://github.com/crsh/papaja

Conigrave, J. (2020). *Corx: Create and format correlation matrices.* Retrieved from https://CRAN.R-project.org/package=corx

Fox, J., & Weisberg, S. (2019). *An R companion to applied regression* (Third). Thousand Oaks CA: Sage. Retrieved from https://socialsciences.mcmaster.ca/jfox/Books/Companion/

Fox, J., Weisberg, S., & Price, B. (2020). *CarData: Companion to applied regression data sets.* Retrieved from https://CRAN.R-project.org/package=carData

Table 5

Coefficients for X variables, first function.

X Variables	Standardized X canonical coefficients	Structure coefficient (rs)	Squared structure
Affective Sharing	-0.50	-0.62	0.38
Cognitive Empathy	0.48	0.25	0.06
Empathic Concern	0.06	0.02	0.00
Empathic Distress	-0.34	-0.49	0.24
Silent Films	-0.01	-0.02	0.00
Sex	-0.46	-0.60	0.36
IQ	0.08	0.08	0.01
Parent Education	-0.09	-0.02	0.00
Neighborhood Advantage	0.34	0.34	0.12

Note. * Survive correction for multiple comparisons (Bonferroni).

68 Grolemund, G., & Wickham, H. (2011). Dates and times made easy with lubridate.

69 *Journal of Statistical Software*, *40*(3), 1–25. Retrieved from

70 http://www.jstatsoft.org/v40/i03/

71 R Core Team. (2020). *R: A language and environment for statistical computing.* Vienna,

72 Austria: R Foundation for Statistical Computing. Retrieved from

73 https://www.R-project.org/

74 Revelle, W. (2019). *Psych: Procedures for psychological, psychometric, and personality*

75 *research.* Evanston, Illinois: Northwestern University. Retrieved from

76 https://CRAN.R-project.org/package=psych

77 Wickham, H. (2011). The split-apply-combine strategy for data analysis. *Journal of*

78 *Statistical Software*, *40*(1), 1–29. Retrieved from http://www.jstatsoft.org/v40/i01/

Table 6

Coefficients for Y variables, first function.

Y Variables	Standardized X canonical coefficients	Structure coefficient (rs)	Squared
Negative mood/physical symptoms	-0.04	-0.37	0
Negative self-esteem	-0.05	-0.30	0
Ineffectiveness	-0.23	-0.46	0
Interpersonal problems	0.05	-0.30	0
Separation anxiety	-0.47	-0.74	0
Social phobia	-0.72	-0.86	0
Physical injury fears	-0.06	-0.50	0
Generalized anxiety	-0.19	-0.55	0
Obsessive compulsive	0.28	-0.36	0
Panic/agoraphobia	0.34	-0.37	0

Note. * Survive correction for multiple comparisons (Bonferroni).

[79] Wickham, H. (2016). *Ggplot2: Elegant graphics for data analysis.* Springer-Verlag New York. Retrieved from https://ggplot2.tidyverse.org

[81] Wickham, H., François, R., Henry, L., & Müller, K. (2020). *Dplyr: A grammar of data manipulation.* Retrieved from https://CRAN.R-project.org/package=dplyr