Activity Engagement and Cognitive Performance from Mid-Adolescence to Mid-Adulthood

Brittany P. Trubenstein[1], Brett C. Haberstick[2], Robin Corley[2], Sally J. Wadsworth[2], Chandra A. Reynolds[1]

[1]University of California - Riverside, [2]University of Colorado - Boulder

ABSTRACT

The active model of Cognitive Reserve Theory posits that engagement in activities may be one pathway by which the threshold at which observable cognitive decline is altered. Prior research has shown the benefits of cognitive and physical activity engagement as well as social participation to an array of late life health outcomes, including cognitive health.

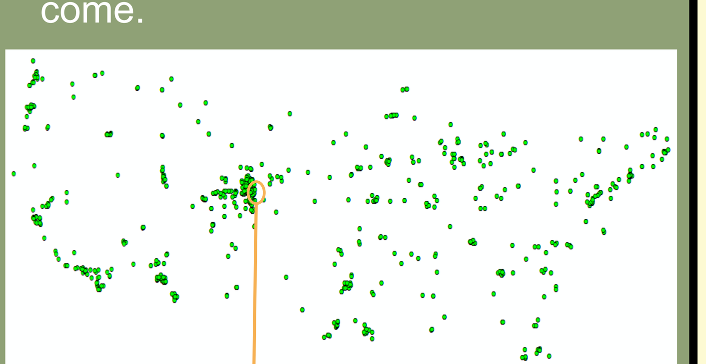
The current study evaluated 1,703 individuals from the CATSLife study [*M*age = 33.23 years; SD=5.05; 51.3% male]. Latent change score models were used to evaluate how engagement in activity at the year 16 assessment predict change in cognitive performance at midlife as well as how cognitive performance at the year 16 assessment predicts change in activity engagement at midlife.

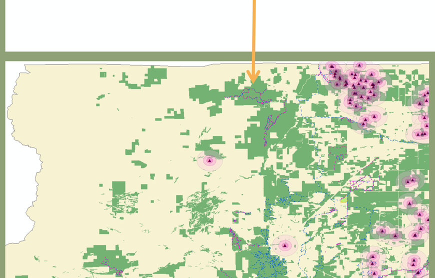
This study did not find significant cross-time associations between general cognitive ability and any of the activity domains (physical, social, cognitive). For memory tasks, modest associations between episodic memory (picture memory, names & faces) performance and social activity in adulthood was observed (*r*'s = .09, p < .05). Only picture memory performance significantly predicted change in social activity in adulthood, supportive of environmental selection (p = .04).

Future studies will further evaluate the effects of activity engagement on other cognitive domains.

Participant Distribution

Our participants are distributed across the USA with a higher concentration living in or around the front range region of CO, including Boulder County (see inset). This distribution offers a unique opportunity to investigate different activity engagement opportunities available to the participants. Additional environmental influence studies to come.





Although precise address location was used for actual analyses, dots in figure have been adjusted to maintain participant confidentiality.

CONTACT
Paige Trubenstein
CATSLife – U.C. Riverside
Email: btrub001@ucr.edu
Website: bbr.ucr.edu

INTRODUCTION

The activities individuals engage in during their non-working hours, or their leisure time activities, have been found to have impacts on cognitive performance across the lifespan, supporting cognitive reserve theories[1-2] however, earlier age periods are understudied from a prospective viewpoint. Moreover, largely unmapped in the literature are the complex interdependent features of activities that include cognitive, social and physical attributes, though researchers often categorize activities into one of these domains[3-10].

In the current study, we examine:

- prospective contributions of activity engagement along cognitive, social and physical dimensions to cognitive performance and change from mid-adolescence to the verge of mid-adulthood. Moreover, we account for cross domain features of activity types.
- the contribution of cognitive performance on later activity engagement, which to our knowledge has rarely been simultaneously considered.

H1: Individuals who spend more time in engaging cognitive, social or physical activities in mid-adolescence will show stability or growth in cognitive performance at midlife.
H2: Cognitive performance in mid-adolescence will predict differential change in activity levels at midlife.

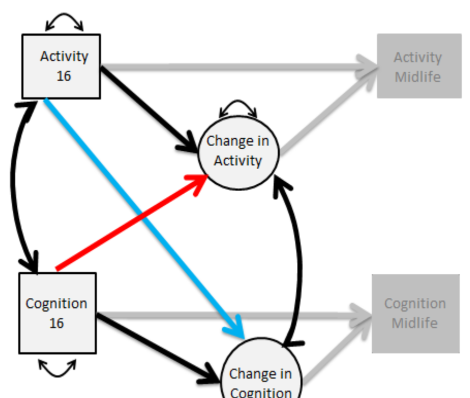


Figure 1. Theoretical model showing keys paths that test Cognitive Reserve versus Environmental Selection.

METHODS AND MATERIALS

Sample. The current study evaluated 1703 individuals from the CATSLife study [*M*age = 33.23 years; SD=5.05; 51.3% male] that stems from the CAP and LTS studies[13,14]. Year 16 assessments and data from the on-going CATSLife wave (March 2017, N = 609) were included.

Measures. The Leisure Time Activity Questionnaire includes 19 items that assess how individuals spend leisure time[12]; e.g., "How many hours per week do you spend practicing different physical activities?" Participants answered on a 6 point Likert scale ranging from 0 to 8 hours or more per week. Additionally, self-reported talents & interests on a list of activities falling into social, cognitive and physical domains were asked and correlated with engagement in Leisure Time Activities. Scoring: 15 raters (27% male; *M*age=21.21) scored each activity as to the level of physical, social or cognitive association [0=none, 1=low, 2=moderate, to 3=high]. Mean ratings were used as weights to form composites of physical, social and cognitive activity engagement at both assessments.[c.f. 8]

Cognition. A first principal component of 9 specific cognitive ability measures formed a general cognitive ability score (g). We also evaluated the episodic memory tests (Picture Memory & Names and Faces) individually.

Table 1: Descriptive at year 16 & CATSLife

	N	Min.	Max	Mean	SD	Variance
Age						
Year 16	1703	15.80	36.06	16.77	1.66	2.74
CATSLife	657	28.06	46.14	33.23	4.92	24.21
Follow-up (years)	593	8.54	30.14	16.62	5.05	25.50
Activity Domains						
Cognitive 16yrs	1080	10.00	90.00	42.64	12.38	153.24
Social 16yrs	1080	6.50	115.50	55.14	16.49	271.88
Physical 16yrs	1080	0.50	89.50	34.46	14.67	215.27
Cognitive Adult	655	6.50	64.00	35.04	10.08	101.54
Social Adult	655	4.00	82.00	41.85	12.88	166.02
Physical Adult	655	2.00	67.50	26.82	10.51	110.53
Cognitive						
g 16yrs	1657	0.43	83.42	50.14	10.41	108.35
Picture Memory 16yrs	1698	6.45	70.71	49.16	10.33	106.81
Names & Faces 16yrs	1693	28.12	83.42	49.86	10.07	101.45
g Adult	590	13.76	87.98	56.08	11.14	124.04
Picture Memory Adult	600	10.57	69.94	45.45	10.60	112.38
Names & Faces Adult	612	28.12	82.64	48.92	9.45	89.36

Note. g=First principal component of 9 cognitive tests; 16yrs=year 16 assessment.

RESULTS

Frequency of Activity Engagement and reported Talents & Interests.

- Participants reported talents and interests in multiple activities as well as how often they engage in those activities.
- Self reported talents in activities were correlated with engagement in activities (r range = -0.15 - 0.32; r mean = 0.08; r median = 0.09; N range = 295 - 1389).
- Self reported interests in activities were correlated with engagement in activities (r range = -0.15 – 0.27; r mean = 0.07; r median = 0.08; N range = 314 - 1437).

Frequency of Activity Engagement and Cognition, within & across time.
Associations within age period between activity engagement and cognitive performance ranged from 0.02 to 0.07 at year 16, and 0.02 to 0.14 at the CATSLife wave, with the most consistent correlations between activity engagement and Picture Memory (r's =0.10 - 0.14, p < 0.05). Few significant cross-time associations between g and the activity domains (physical, social, cognitive) were observed. For memory tasks, modest associations between episodic memory (Picture Memory, Names & Faces) performance and social activity in adulthood was observed (r's = 0.09, p < 0.05).

Latent Change Models of Activity Engagement and Cognition.
General Cognitive Factor (g). Constraining the paths from year 16 activity engagement or year 16 g to latent change across traits did not significantly worsen the fit of the model. All p > 0.40.

Names and Faces. Dropping the path from year 16 Physical Activity engagement to change in Names and Faces performance trended towards significance at p = 0.076, suggesting that <u>higher physical activity at year 16 predicts smaller changes in memory performance consistent with a cognitive reserve pathway</u>.

Picture Memory: Dropping the path from year 16 Picture Memory performance to change in Social Activity engagement was significant at p = 0.05 suggesting <u>support for an environmental selection pathway.</u>

Figure 2. Variation in Picture Memory at 16 years and change in Social Activity: (A) Line Plot; (B) Path Model results.
At the average social activity at age 16, those with higher picture memory scores (PMEM) show smaller declines in Social Activity 17 years later than those with average or less than average memory scores.

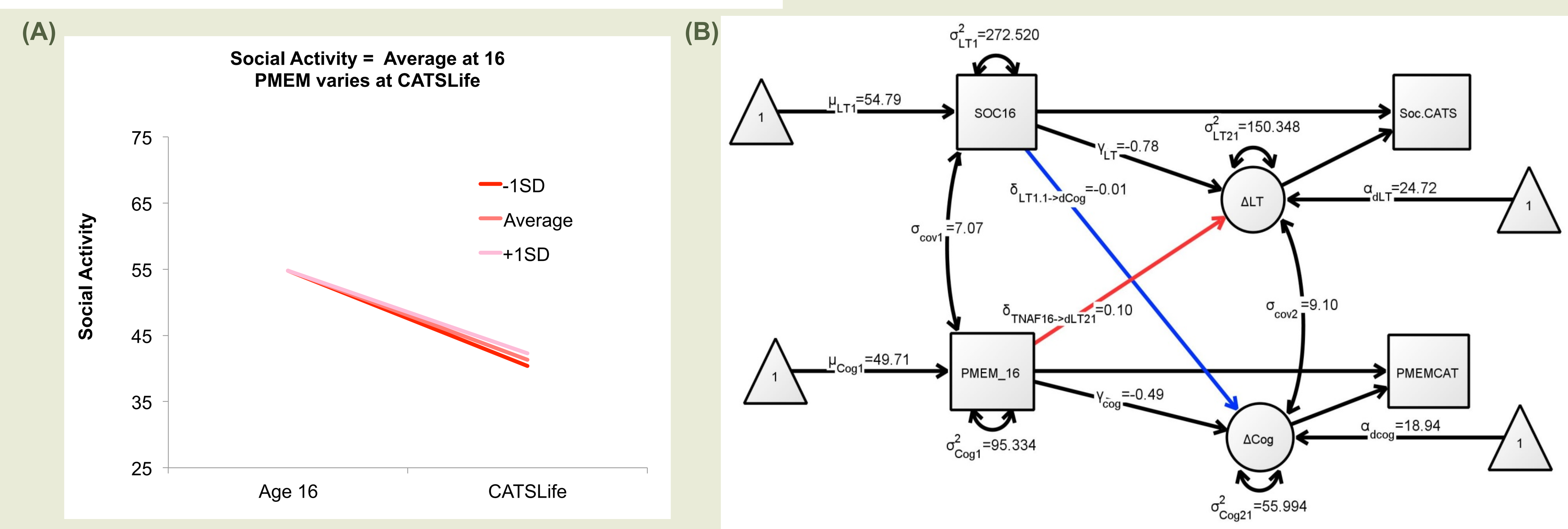


Table 2. Correlations between Activity and Cognitive performance: Year 16 and CATSLife

	1	2	3	4	5	6	7	8	9	10	11	12
1. Cog 16yrs	1											
2. Soc 16yrs	0.94**	1										
3. Phy 16yrs	0.87**	0.87**	1									
4. Cog Adult	0.24**	0.20**	0.17**	1								
5. Soc Adult	0.27**	0.26**	0.22**	0.91**	1							
6. Phy Adult	0.22**	0.24**	0.28**	0.80**	0.83**	1						
7. g 16yrs	0.06	0.02	0.03	0.03	0.01	-0.01	1					
8. Pic. Mem 16yrs	0.05	0.03	0.04	0.07	0.09*	0.05	0.38**	1				
9. Names & Faces 16yrs	0.07*	0.07*	0.05	0.05	0.09*	0.04	0.51**	0.28**	1			
10. g Adult	0.05	0.03	0.03	0.11**	0.07	0.06	0.82**	0.35**	0.39**	1		
11. Pic. Mem. Adult	0.07	0.04	0.04	0.14**	0.13**	0.10*	0.28**	0.49**	0.30**	0.39**	1	
11. Names & Faces Adult	-0.02	-0.04	-0.07	0.04	0.05	0.02	0.40**	0.28**	0.61**	0.51**	0.33**	1

**p< 0.01 level; *p< 0.05 level; N range 372-1080

Note. g=First PC of 9 tests; Pic. Mem= Picture Memory cognitive task; 16yrs=year 16 assessment.

DISCUSSION

In the current study we considered the prospective long-term benefit that activity engagement at mid-adolescence may confer on cognitive performance at midlife, while considering the extent to which cognitive performance at mid-adolescence may subsequently influence differential engagement in activities at midlife.

- Physical and cognitive activity engagement at mid-adolescence did not have a significant effect on cognitive change but social activity at mid-adolescence showed significant effects on change across 17 years for our picture memory episodic memory task.
  - **H1:** that individuals who spend more time in engaging cognitive, social or physical activities in mid-adolescence will show stability or growth in cognitive performance at midlife was not supported.
  - **H2:** that cognitive performance in mid-adolescence would predict differential change in activity levels at midlife was partially supported whereby episodic memory (Picture Memory) modestly predicted differential change in social activity across 17 years.

Acknowledgements

NIH AG046938 [MPIs, Chandra A. Reynolds (Contact), Sally J. Wadsworth].

The content of this presentation is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health

References

1. Stern 2002; 2. Stern 2002; 3. Bennett et al., 2006; 4. Karp et al., 2006 5. Scarmeas, Levy, Tang, Manly & Stern 2001; 6. Sofi et al. 2011; 7. Taaffe et al. 2008; 8. Wang, Karp, Winblad & Fratiglioni 2002; 9. Wilson et al., 2013; 10. Wilson et al., 2003; 11. Schaie & Willis (2016); 12. Haberstick, Zeiger, & Corley, 2014; 13. Plomin & DeFries, 1983; 14. Rhea, 2001