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Introduction

Brain development is influenced by both genetic and environmental factors ¹

Hippocampus

- A subcortical structure involved in stress response
- Influenced by environmental factors that children are exposed to, particularly parental factors ²

Early adverse experiences → hippocampal volume → maladaptive stress response

Positive environment

- The influence of *positive* environments in typically-developing children remains largely understudied ³
- One aspect of a positive caregiving environment is autonomy support ⁴

“the degree to which parents value and use techniques which encourage independent problem solving, choice, and participation”

Past research

- Maternal autonomy support assessed during the preschool years predicted hippocampal volumes at school-age over and above concurrent maternal autonomy support ^{5, 6}
- No study has yet investigated the link between maternal autonomy support during infancy and later brain structures

The current study

- This study aimed to investigate the associations between hippocampal volumes in late childhood and maternal autonomy support at two time-points:
 - Infancy, a period characterized by enhanced brain plasticity
 - Preschool years

Method

Participants

- 28 children (11 boys) and their mothers were met when children were aged 15 months (T1), 3 years (T2), and 10 years (T3)

Measures

Maternal autonomy support

- Videotaped challenging problem-solving task (T1) and a videotaped clean-up task (T2)
- Whipple and colleagues' (2011) rating system ⁷
- Autonomy-supportive behaviors: scaffolding, encouraging the child verbally, providing choices to the child, and following his or her rhythm
- High inter-rater reliability (ICC = .86 and .93)

Brain imaging

- At T3, children underwent a magnetic resonance imaging scan using a standard 3D T1-weighted whole-brain protocol

Statistical analyses

- Left and right hippocampal volumes (in mm³) were obtained using FreeSurfer 5.3 (see Figure 1) and were analyzed separately ⁸
- Multiple regressions were performed in SPSS to predict hippocampal volumes based on maternal autonomy-support
- A ratio of right or left hippocampal volume on total intracranial volume was used as the dependent variable
- Child age & maternal education were used as covariates

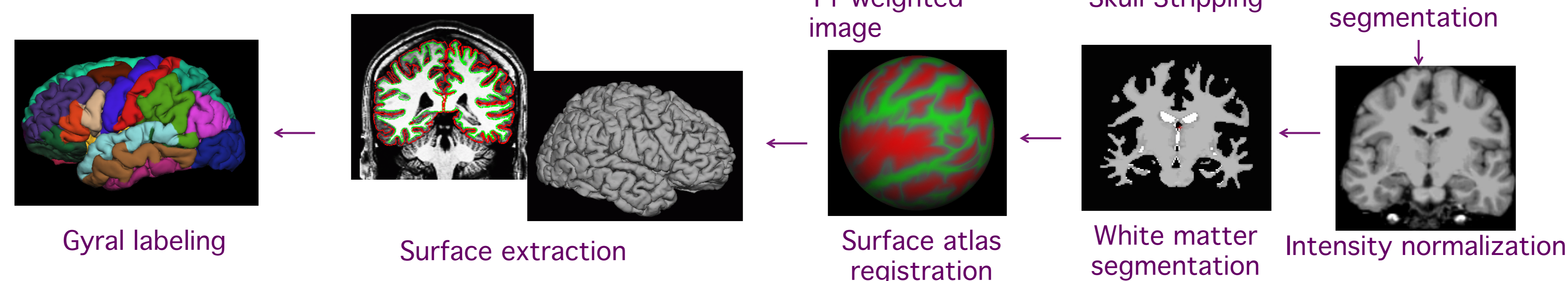


Figure 1. An overview of step processing of the FreeSurfer 5.3 image analysis suite. Adapted from Anatomical analysis with FreeSurfer, FreeSurfer (<http://surfer.nmr.mgh.harvard.edu/>)

Results

Infancy

Table 1. Left and Right Hippocampal Volumes Predicted by Maternal Autonomy Support in Infancy

	β	p	ΔR^2
Left Hippocampus			
Age	.178	.339	.20
Maternal education	-.230	.210	
Maternal autonomy support	-.397	.044*	.14
Right Hippocampus			
Age	.181	.344	.19
Maternal education	-.236	.210	
Maternal autonomy support	-.359	.073 [†]	.11

[†] $p < .10$. * $p < .05$.

Preschool years

- No relations were found between preschool autonomy support and
 - the left ($\beta = -.175$, $p = .393$)
 - or right hippocampal volume ($\beta = -.254$, $p = .213$).

Conclusion

- Past research has shed light on the importance of early childhood autonomy support for hippocampal development ^{5, 6}

Our contribution

Infancy

- First study to demonstrate that maternal autonomy-supportive behaviors in infancy have implications for later hippocampal volumes
- Positive caregiving behavior → long-lasting influence on subcortical structures (over 9 years)

Preschool years

- Previous studies found a link between maternal autonomy support during the preschool years and hippocampal volumes ^{5, 6}
- Our failure to find significant relations between these two variables may be due to the small sample size

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