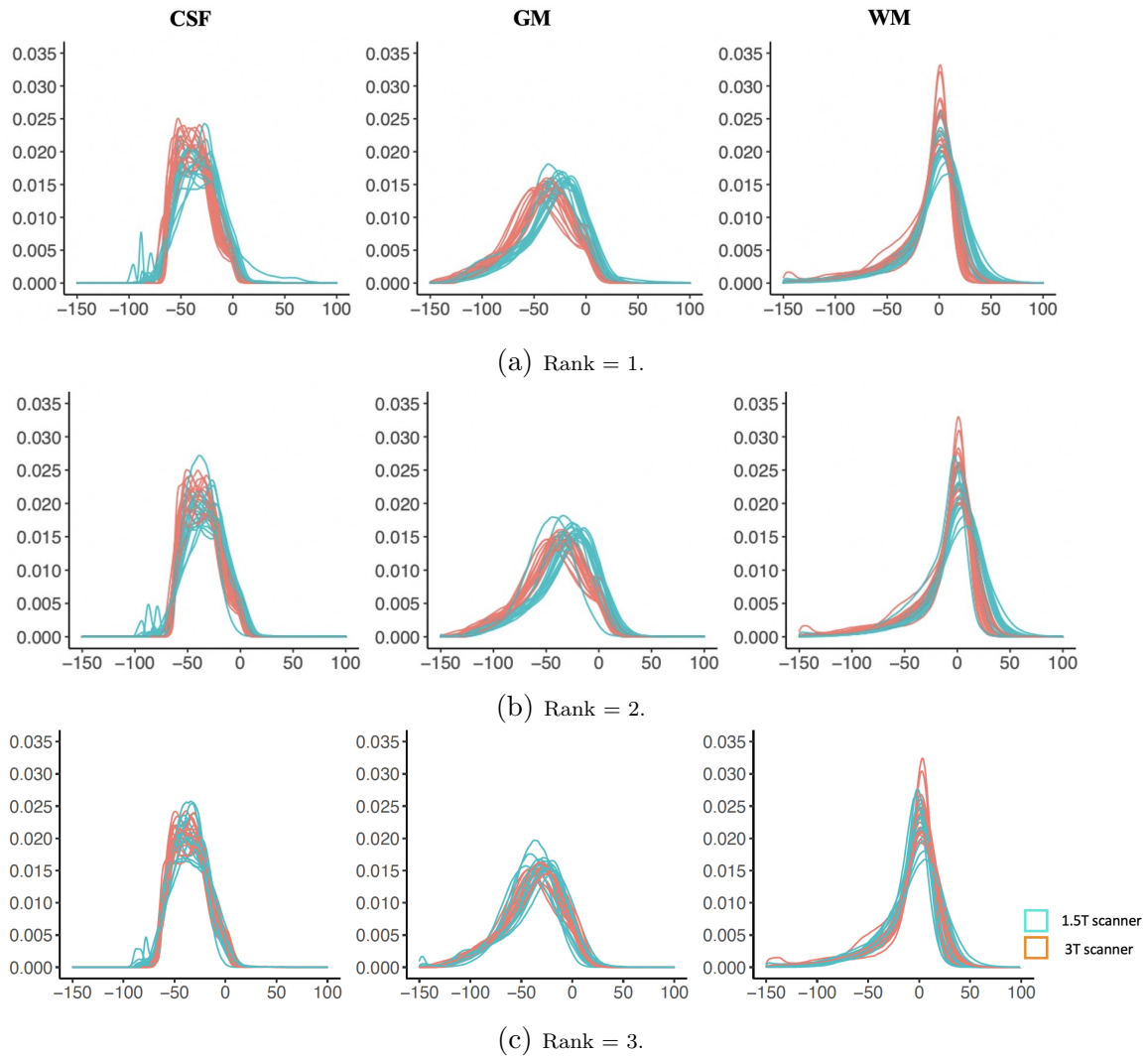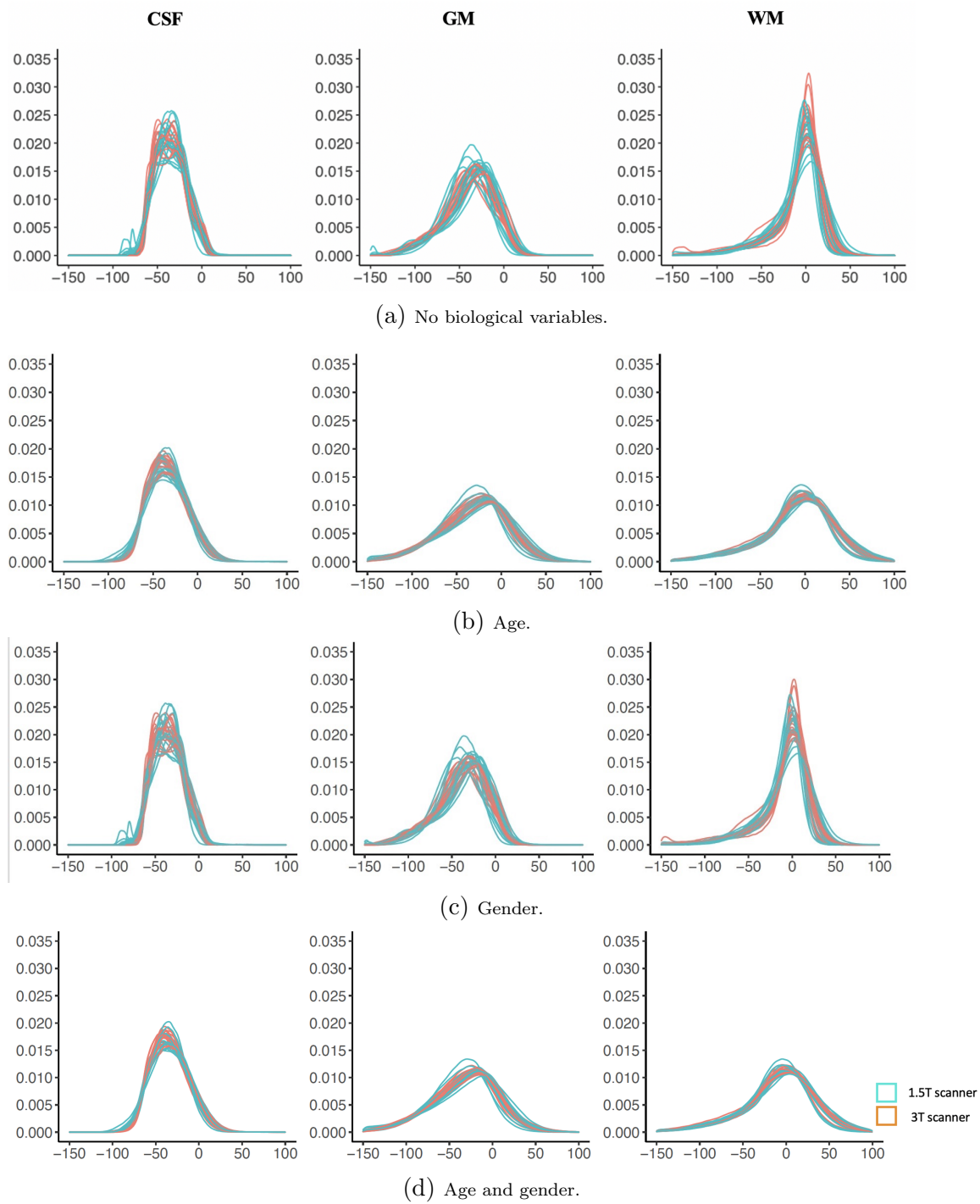**Supplementary File 1**

For fitting RAVEL to our data, we explored the effects of the decomposition rank b and the biological variables age and gender on density plots of tissue types: CSF, GM, and WM. Supplementary Figure 1 contains the plots for which rank was set to either one, two, or three. The results showed that the higher rank, in our case three, gave us greater overlap of the plots, which means better intensity normalization. In the second set of experiments, we controlled models for age and/or gender. The density plots for each of these settings were depicted in Supplementary Figure 2, in which rank was fixed to three. We observed that while controlling for gender did not change the density plots, age widened them, specifically the plots for the WM and GM. Wider density plots could be evidence of resulting in images with lower quality/contrast, which was the exact case for our images. Based on these observations, we decided to fix rank to three and control for no biological variables, when we fitted the final model.

Supplementary Figure 1: Density plots of MRI voxel intensities by tissue type (cerebrospinal fluid (CSF), grey matter (GM), and white matter (WM)) across scanners (GE 1.5T (orange) and Siemens 3T (cyan)) by setting (a) Rank = 1, (b) Rank = 2, and (c) Rank = 3.

Supplementary Figure 2: Density plots of MRI voxel intensities by tissue type (cerebrospinal fluid (CSF), grey matter (GM), and white matter (WM)) across scanners (GE 1.5T (orange) and Siemens 3T (cyan)), controlling for (a) no biological variables, (b) age, (c) gender, and (d) age and gender.

Supplementary Table 1: Descriptive statistics, including mean and standard deviation (SD) for FS-derived cortical thickness and volume measures relevant to AD. These statistics are reported for the RAW, RAVEL-normalized, ComBat-harmonized, and RAVEL-ComBat-harmonized measures across GE 1.5T and Siemens 3T scanners. Initially referenced in section 3.1.

	RAW		RAVEL		ComBat		RAVEL-ComBat	
	1.5T	3T	1.5T	3T	1.5T	3T	1.5T	3T
ROIs	Cortical Thickness (mm)							
Left								
Entorhinal	2.96 (0.29)	3.18 (0.37)	2.93 (0.29)	3.12 (0.40)	3.03 (0.28)	3.11 (0.36)	2.94 (0.28)	3.12 (0.38)
Fusiform	2.25 (0.18)	2.50 (0.15)	2.37 (0.25)	2.47 (0.17)	2.32 (0.17)	2.43 (0.16)	2.37 (0.21)	2.47 (0.19)
Inferior Parietal	2.13 (0.15)	2.08 (0.13)	2.22 (0.21)	2.07 (0.13)	2.13 (0.14)	2.09 (0.14)	2.18 (0.18)	2.12 (0.15)
Inferior Temporal	2.32 (0.21)	2.57 (0.17)	2.48 (0.30)	2.54 (0.18)	2.39 (0.19)	2.50 (0.17)	2.47 (0.26)	2.55 (0.21)
Middle Temporal	2.52 (0.24)	2.60 (0.25)	2.59 (0.22)	2.57 (0.23)	2.55 (0.23)	2.57 (0.25)	2.56 (0.21)	2.60 (0.24)
Right								
Entorhinal	3.00 (0.40)	3.24 (0.35)	3.04 (0.24)	3.22 (0.31)	3.08 (0.38)	3.16 (0.36)	3.05 (0.22)	3.21 (0.30)
Fusiform	2.32 (0.18)	2.54 (0.18)	2.43 (0.20)	2.48 (0.16)	2.38 (0.17)	2.48 (0.18)	2.42 (0.18)	2.48 (0.18)
Inferior Parietal	2.14 (0.19)	2.13 (0.15)	2.20 (0.20)	2.13 (0.14)	2.15 (0.18)	2.12 (0.15)	2.17 (0.18)	2.16 (0.16)
Inferior Temporal	2.33 (0.20)	2.59 (0.15)	2.41 (0.17)	2.51 (0.16)	2.40 (0.18)	2.52 (0.15)	2.42 (0.15)	2.50 (0.16)
Middle Temporal	2.55 (0.19)	2.60 (0.21)	2.60 (0.16)	2.59 (0.21)	2.57 (0.19)	2.58 (0.20)	2.58 (0.15)	2.61 (0.20)
ROIs	Volume $(cm)^3$							
Left								
Entorhinal	1.64 (0.32)	1.72 (0.30)	1.54 (0.34)	1.74 (0.38)	1.68 (0.32)	1.68 (0.29)	1.58 (0.34)	1.70 (0.35)
Inferior Temporal	8.05 (1.03)	8.84 (1.57)	8.48 (1.00)	8.91 (1.53)	8.29 (1.10)	8.60 (1.42)	8.56 (1.04)	8.82 (1.41)
Middle Temporal	8.80 (1.58)	8.96 (2.00)	9.26 (1.44)	8.91 (1.81)	8.96 (1.66)	8.80 (1.84)	9.21 (1.47)	8.97 (1.69)
Amygdala	1.40 (0.26)	1.53 (0.30)	1.43 (0.21)	1.52 (0.25)	1.43 (0.26)	1.50 (0.28)	1.46 (0.22)	1.50 (0.23)
Hippocampus	3.85 (0.46)	3.77 (0.48)	4.00 (0.47)	3.81 (0.49)	3.82 (0.46)	3.79 (0.46)	3.94 (0.47)	3.86 (0.46)
Right								
Entorhinal	1.60 (0.34)	1.69 (0.36)	1.55 (0.33)	1.67 (0.35)	1.65 (0.35)	1.65 (0.33)	1.57 (0.33)	1.65 (0.33)
Inferior Temporal	7.71 (1.23)	8.69 (1.62)	7.98 (1.37)	8.64 (1.52)	7.99 (1.29)	8.41 (1.49)	8.11 (1.38)	8.51 (1.43)
Middle Temporal	9.48 (1.35)	9.70 (1.87)	9.74 (1.39)	9.80 (1.73)	9.64 (1.43)	9.54 (1.71)	9.76 (1.42)	9.78 (1.61)
Amygdala	1.55 (0.21)	1.60 (0.21)	1.56 (0.19)	1.58 (0.20)	1.56 (0.21)	1.59 (0.20)	1.57 (0.19)	1.57 (0.19)
Hippocampus	3.99 (0.40)	3.90 (0.44)	4.09 (0.46)	3.99 (0.42)	3.96 (0.40)	3.93 (0.42)	4.06 (0.45)	4.02 (0.41)

Values 0.00 and −0.00 indicate values < 0.005 and < −0.005, respectively.

Supplementary Table 2: Mean (95% confidence interval) of cross-scanner differences, (Siemens 3T - GE 1.5T), for cortical thickness and volume measures relevant to AD. These statistics were prepared for each of the RAW, RAVEL, ComBat, and RAVEL-ComBat methods, using the paired t-test. The measures with statistically significant differences ($P < 0.05$) were highlighted.

ROIs	RAW	RAVEL	ComBat	RAVEL-ComBat
		Cortical Thickness (mm)		
Left				
Entorhinal	0.22 (0.09, 0.34)	0.19 (-0.03, 0.41)	0.08 (-0.04, 0.20)	0.18 (-0.04, 0.39)
Fusiform	0.24 (0.19, 0.30)	0.10 (-0.02, 0.23)	0.11 (0.06, 0.16)	0.10 (-0.02, 0.22)
Inferior Parietal	-0.05 (-0.11, 0.0)	-0.15 (-0.26, -0.04)	-0.04 (-0.09, 0.01)	-0.04 (-0.16, 0.04)
Inferior Temporal	0.25 (0.16, 0.34)	0.06 (-0.08, 0.20)	0.11 (0.02, 0.19)	0.08 (-0.05, 0.21)
Middle Temporal	0.08 (0.00, 0.16)	-0.01 (-0.11, 0.09)	0.02 (-0.06, 0.10)	0.03 (-0.07, 0.13)
Right				
Entorhinal	0.23 (0.00, 0.47)	0.17 (-0.01, 0.35)	0.08 (-0.15, 0.31)	0.15 (-0.02, 0.33)
Fusiform	0.22 (0.17, 0.28)	0.05 (-0.06, 0.16)	0.10 (0.04, 0.15)	0.06 (-0.04, 0.17)
Inferior Parietal	-0.02 (-0.06, 0.02)	-0.07 (-0.15, 0.01)	-0.02 (-0.06, 0.01)	-0.01 (-0.09, 0.06)
Inferior Temporal	0.26 (0.19, 0.32)	0.09 (0.01, 0.18)	0.11 (0.06, 0.17)	0.08 (0.00, 0.17)
Middle Temporal	0.05 (-0.03, 0.14)	-0.01 (-0.08, 0.06)	0.01 (-0.08, 0.09)	0.03 (-0.04, 0.10)
ROIs		Volume (cm)^3		
Left				
Entorhinal	0.08 (-0.05, 0.22)	0.19 (-0.03, 0.41)	0.01 (-0.12, 0.14)	0.12 (-0.09, 0.33)
Inferior Temporal	0.79 (0.37, 1.21)	0.43 (-0.01, 0.88)	0.31 (-0.03, 0.66)	0.26 (-0.13, 0.65)
Middle Temporal	0.16 (-0.29, 0.61)	-0.35 (-0.91, 0.21)	-0.16 (-0.55, 0.24)	-0.23 (-0.76, 0.29)
Amygdala	0.13 (0.03, 0.23)	0.09 (0.01, 0.17)	0.06 (-0.04, 0.16)	0.04 (-0.04, 0.11)
Hippocampus	-0.08 (-0.16, -0.01)	-0.19 (-0.29, -0.09)	-0.03 (-0.1, 0.05)	-0.05 (-0.18, 0.01)
Right				
Entorhinal	0.09 (-0.05, 0.23)	0.12 (-0.05, 0.29)	0.01 (-0.13, 0.15)	0.07 (-0.10, 0.24)
Inferior Temporal	0.98 (0.55, 1.40)	0.67 (0.19, 1.14)	0.42 (0.04, 0.80)	0.41 (-0.05, 0.86)
Middle Temporal	0.21 (-0.27, 0.70)	0.06 (-0.39, 0.51)	-0.10 (-0.52, 0.32)	0.02 (-0.40, 0.44)
Amygdala	0.05 (0.01, 0.10)	0.02 (-0.03, 0.06)	0.03 (-0.02, 0.08)	0.01 (-0.04, 0.05)
Hippocampus	-0.09 (-0.16, -0.01)	-0.10 (-0.23, 0.03)	-0.03 (-0.11, 0.04)	-0.04 (-0.17, 0.08)

Values 0.00 and −0.00 indicate values < 0.005 and < -0.005, respectively.

Supplementary File 2: Experiments on different preprocessing pipelines.
For investigating the effects of using different preprocessing for RAW and ComBat, we prepared two corresponding new sets of data with different preprocessing steps. For this, we simply removed the preprocessing step used for generating RAW and ComBat data and prepared two new datasets of RAW_{Orig} and $\text{ComBat}_{\text{Orig}}$. We then compared RAW_{Orig} with RAW and $\text{ComBat}_{\text{Orig}}$ with ComBat, using paired t-test with 95% confidence interval (CI). The results were reported in Supplementary Tables 3 and 4 within each scanner. For each scanner, the first two columns are the mean (SD) of the datasets to compare and the third column is the results of comparison: mean of directional differences (95% CI) generated by the t-test. The statistically significant differences ($P < 0.05$) are highlighted in the tables.

Supplementary Table 3: Comparing different preprocessing pipelines for generating RAW data using paired t-test. For each scanner, the first two columns are the mean (SD) of the corresponding data and the third column is the mean of directional differences (95% confidence interval) of data in the first two columns. The statistically significant differences ($P < 0.05$) were highlighted in the tables.

	1.5T			3T		
	RAW_{Orig}	RAW	RAW_{Orig} - RAW	RAW_{Orig}	RAW	RAW_{Orig} - RAW
ROIs	Cortical Thickness (mm)			Cortical Thickness (mm)		
Left						
Entorhinal	3.06 (0.39)	2.96 (0.29)	0.10 (-0.26, 0.06)	3.42 (0.39)	3.18 (0.37)	0.24 (-0.36, -0.12)
Fusiform	2.42 (0.15)	2.25 (0.18)	0.17 (-0.22, -0.11)	2.50 (0.17)	2.50 (0.15)	0.00 (-0.05, 0.05)
Inferior Parietal	2.20 (0.14)	2.13 (0.15)	0.07 (-0.13, -0.02)	2.07 (0.14)	2.08 (0.13)	-0.01 (-0.02, 0.05)
Inferior Temporal	2.43 (0.17)	2.32 (0.21)	0.11 (-0.19, -0.02)	2.55 (0.17)	2.57 (0.17)	-0.02 (-0.04, 0.09)
Middle Temporal	2.63 (0.25)	2.52 (0.24)	0.11 (-0.19, -0.03)	2.60 (0.23)	2.60 (0.25)	0.00 (-0.06, 0.05)
Right						
Entorhinal	3.17 (0.42)	3.00 (0.40)	0.17 (-0.32, -0.01)	3.58 (0.40)	3.24 (0.35)	0.34 (-0.52, -0.16)
Fusiform	2.47 (0.16)	2.32 (0.18)	0.14 (-0.22, -0.07)	2.60 (0.20)	2.54 (0.18)	0.05 (-0.11, -0.00)
Inferior Parietal	2.20 (0.16)	2.14 (0.19)	0.05 (-0.13, 0.02)	2.16 (0.14)	2.13 (0.15)	0.03 (-0.08, 0.02)
Inferior Temporal	2.41 (0.17)	2.33 (0.20)	0.08 (-0.18, 0.02)	2.65 (0.16)	2.59 (0.15)	0.06 (-0.11, -0.01)
Middle Temporal	2.68 (0.20)	2.55 (0.19)	0.13 (-0.21, -0.05)	2.67 (0.20)	2.60 (0.21)	0.07 (-0.12, -0.01)
ROIs	Volume $(\text{cm})^3$			Volume $(\text{cm})^3$		
Left						
Entorhinal	1.68 (0.27)	1.64 (0.32)	0.04 (-0.26, 0.19)	1.68 (0.34)	1.72 (0.30)	-0.05 (-0.07, 0.16)
Inferior Temporal	8.20 (1.73)	8.05 (1.03)	0.15 (-0.65, 0.35)	8.50 (1.57)	8.84 (1.57)	-0.34 (0.12, 0.56)
Middle Temporal	8.49 (1.90)	8.80 (1.58)	-0.31 (-0.00, 0.63)	8.54 (1.86)	8.96 (2.00)	-0.42 (0.14, 0.70)
Amygdala	1.39 (0.21)	1.40 (0.26)	-0.01 (-0.05, 0.08)	1.46 (0.31)	1.53 (0.30)	-0.07 (-0.01, 0.15)
Hippocampus	3.97 (0.58)	3.85 (0.46)	0.11 (-0.22, -0.01)	3.76 (0.55)	3.77 (0.48)	-0.01 (-0.08, 0.09)
Right						
Entorhinal	1.45 (0.28)	1.60 (0.34)	-0.15 (0.03, 0.27)	1.59 (0.34)	1.69 (0.36)	-0.10 (-0.01, 0.21)
Inferior Temporal	7.77 (1.49)	7.71 (1.23)	0.06 (-0.41, 0.29)	8.39 (1.51)	8.69 (1.62)	-0.30 (0.05, 0.56)
Middle Temporal	9.63 (1.71)	9.48 (1.35)	0.14 (-0.53, 0.24)	9.55 (1.75)	9.70 (1.87)	-0.15 (-0.08, 0.38)
Amygdala	1.43 (0.19)	1.55 (0.21)	-0.11 (0.05, 0.18)	1.43 (0.23)	1.60 (0.21)	-0.17 (0.10, 0.24)
Hippocampus	4.02 (0.49)	3.99 (0.40)	0.04 (-0.15, 0.07)	3.86 (0.52)	3.90 (0.44)	-0.04 (-0.06, 0.14)

Values 0.00 and -0.00 indicate values < 0.005 and < -0.005, respectively.

Supplementary Table 4: Comparing different preprocessing pipelines for generating ComBat data using paired t-test. For each scanner, the first two columns are the mean (SD) of the corresponding data and the third column is the mean of directional differences (95% confidence interval) of data in the first two columns. The statistically significant differences ($P < 0.05$) were highlighted in the tables.

	1.5T			3T		
	$ComBat_{Orig}$	ComBat	$ComBat_{Orig}$ - ComBat	$ComBat_{Orig}$	ComBat	$ComBat_{Orig}$ - ComBat
ROIs	Cortical Thickness (mm)			Cortical Thickness (mm)		
Left						
Entorhinal	3.14 (0.38)	3.03 (0.28)	0.11 (-0.05, 0.26)	3.35 (0.37)	3.11 (0.36)	0.23 (0.12, 0.34)
Fusiform	2.43 (0.15)	2.32 (0.17)	0.11 (0.06, 0.16)	2.48 (0.16)	2.43 (0.16)	0.05 (0.01, 0.10)
Inferior Parietal	2.16 (0.14)	2.13 (0.14)	0.04 (-0.02, 0.09)	2.11 (0.13)	2.09 (0.14)	0.02 (-0.01, 0.05)
Inferior Temporal	2.45 (0.16)	2.39 (0.19)	0.06 (-0.02, 0.14)	2.52 (0.17)	2.50 (0.17)	0.03 (-0.04, 0.09)
Middle Temporal	2.61 (0.24)	2.55 (0.23)	0.06 (-0.01, 0.14)	2.62 (0.22)	2.57 (0.25)	0.05 (-0.00, 0.10)
Right						
Entorhinal	3.26 (0.41)	3.08 (0.38)	0.18 (0.03, 0.33)	3.49 (0.38)	3.16 (0.36)	0.33 (0.15, 0.50)
Fusiform	2.49 (0.16)	2.38 (0.17)	0.11 (0.03, 0.18)	2.57 (0.18)	2.48 (0.18)	0.09 (0.04, 0.14)
Inferior Parietal	2.18 (0.16)	2.15 (0.18)	0.03 (-0.04, 0.10)	2.18 (0.13)	2.12 (0.15)	0.05 (0.0, 0.10)
Inferior Temporal	2.46 (0.16)	2.4 (0.18)	0.06 (-0.03, 0.15)	2.59 (0.15)	2.52 (0.15)	0.08 (0.03, 0.12)
Middle Temporal	2.66 (0.20)	2.57 (0.19)	0.10 (0.02, 0.18)	2.68 (0.19)	2.58 (0.20)	0.10 (0.05, 0.15)
ROIs	Volume $(cm)^3$			Volume $(cm)^3$		
Left						
Entorhinal	1.68 (0.27)	1.68 (0.32)	0.00 (-0.22, 0.23)	1.68 (0.32)	1.68 (0.29)	-0.01 (-0.12, 0.10)
Inferior Temporal	8.25 (1.67)	8.29 (1.10)	-0.04 (-0.49, 0.42)	8.46 (1.54)	8.60 (1.42)	-0.15 (-0.36, 0.07)
Middle Temporal	8.50 (1.85)	8.96 (1.66)	-0.46 (-0.75, -0.17)	8.53 (1.81)	8.80 (1.84)	-0.28 (-0.53, -0.02)
Amygdala	1.40 (0.22)	1.43 (0.26)	-0.03 (-0.10, 0.04)	1.44 (0.29)	1.50 (0.28)	-0.06 (-0.13, 0.02)
Hippocampus	3.90 (0.56)	3.82 (0.46)	0.08 (-0.02, 0.18)	3.82 (0.55)	3.79 (0.46)	0.03 (-0.06, 0.11)
Right						
Entorhinal	1.47 (0.27)	1.65 (0.35)	-0.17 (-0.29, -0.05)	1.57 (0.33)	1.65 (0.33)	-0.08 (-0.18, 0.02)
Inferior Temporal	7.86 (1.45)	7.99 (1.29)	-0.13 (-0.46, 0.21)	8.30 (1.47)	8.41 (1.49)	-0.11 (-0.34, 0.12)
Middle Temporal	9.62 (1.67)	9.64 (1.43)	-0.02 (-0.38, 0.35)	9.55 (1.70)	9.54 (1.71)	0.01 (-0.20, 0.22)
Amygdala	1.43 (0.19)	1.56 (0.21)	-0.13 (-0.20, -0.06)	1.43 (0.22)	1.59 (0.20)	-0.15 (-0.22, -0.08)
Hippocampus	3.97 (0.48)	3.96 (0.40)	0.01 (-0.09, 0.12)	3.91 (0.51)	3.93 (0.42)	-0.02 (-0.11, 0.08)

Values 0.00 and -0.00 indicate values < 0.005 and < -0.005, respectively.

Supplementary Table 5: Mean (SD) of FS-derived cortical thickness and volume measures relevant to AD. These statistics are reported for the ComBat-harmonized and Longitudinal-ComBat-harmonized measures across GE 1.5T and Siemens 3T scanners.

	ComBat		Longitudinal ComBat	
	1.5T	3T	1.5T	3T
ROIs	Cortical Thickness (mm)			
Left				
Entorhinal	3.03 (0.28)	3.11 (0.36)	3.07 (0.28)	3.07 (0.37)
Fusiform	2.32 (0.17)	2.43 (0.16)	2.37 (0.18)	2.38 (0.15)
Inferior Parietal	2.13 (0.14)	2.09 (0.14)	2.11 (0.15)	2.10 (0.13)
Inferior Temporal	2.39 (0.19)	2.50 (0.17)	2.44 (0.20)	2.45 (0.17)
Middle Temporal	2.55 (0.23)	2.57 (0.25)	2.56 (0.23)	2.56 (0.25)
Right				
Entorhinal	3.08 (0.38)	3.16 (0.36)	3.13 (0.39)	3.11 (0.36)
Fusiform	2.38 (0.17)	2.48 (0.18)	2.43 (0.18)	2.44 (0.18)
Inferior Parietal	2.15 (0.18)	2.12 (0.15)	2.14 (0.19)	2.13 (0.15)
Inferior Temporal	2.40 (0.18)	2.52 (0.15)	2.45 (0.19)	2.46 (0.15)
Middle Temporal	2.57 (0.19)	2.58 (0.20)	2.58 (0.19)	2.57 (0.21)
ROIs	Volume $(cm)^3$			
Left				
Entorhinal	1.68 (0.32)	1.68 (0.29)	1.68 (0.32)	1.68 (0.30)
Inferior Temporal	8.29 (1.10)	8.6 (1.42)	8.41 (1.03)	8.49 (1.52)
Inferior Parietal	8.96 (1.66)	8.80 (1.84)	8.89 (1.58)	8.87 (1.97)
Amygdala	1.43 (0.26)	1.50 (0.28)	1.46 (0.26)	1.47 (0.29)
Hippocampus	3.82 (0.46)	3.79 (0.46)	3.82 (0.46)	3.80 (0.48)
Right				
Entorhinal	1.65 (0.35)	1.65 (0.33)	1.65 (0.35)	1.65 (0.35)
Inferior Temporal	7.99 (1.29)	8.41 (1.49)	8.15 (1.23)	8.26 (1.59)
Inferior Parietal	9.64 (1.43)	9.54 (1.71)	9.6 (1.35)	9.58 (1.82)
Amygdala	1.56 (0.21)	1.59 (0.20)	1.57 (0.22)	1.58 (0.21)
Hippocampus	3.96 (0.40)	3.93 (0.42)	3.95 (0.40)	3.93 (0.43)