```python
In [39]: # Haxby dataset: 6 people viewing 8 object categories
         # Brain responses recorded during visual recognition
         # ~1450 time points per person

         import numpy as np
         import matplotlib.pyplot as plt
         from sklearn.decomposition import FastICA
         from nilearn import datasets
         from nilearn.masking import compute_epi_mask, apply_mask
         from nilearn.image import smooth_img, load_img
         import warnings
         warnings.filterwarnings('ignore')

         print("Downloading fMRI data...")

         haxby = datasets.fetch_haxby()
         fmri_img = load_img(haxby.func[0])
         print("Haxby dataset loaded")

         print("Original shape:", fmri_img.shape)

         print("Smoothing and masking...")
         smoothed = smooth_img(fmri_img, fwhm=6) #Reduces noise, improves signal qual
         mask = compute_epi_mask(smoothed) #Creates a mask = identifies which voxels
         #Removes skull, background
         fmri_data = apply_mask(smoothed, mask) #Keeps only brain voxels (removes nor

         print("fMRI data shape:", fmri_data.shape)
         print("  Time points:", fmri_data.shape[0])
         print("  Brain voxels:", fmri_data.shape[1])

         print("\nStandardizing data...")
         fmri_data = (fmri_data - fmri_data.mean(axis=0)) / fmri_data.std(axis=0)

         print("Applying ICA...")
         ica = FastICA(n_components=10, random_state=42, max_iter=500)
         components = ica.fit_transform(fmri_data)

         print("ICA Completed!")
         print("Components shape:", components.shape)

         print("\nPlotting components...")
         plt.figure(figsize=(16, 6))

         for i in range(10):
             plt.subplot(2, 5, i+1)
             plt.plot(components[:, i], linewidth=1)
             plt.title(f'Component {i+1}')
             plt.xlabel('Time')
             plt.grid()
         plt.tight_layout()
         plt.show()
```

```python
#The y-axis = Brain activity level (strength of network activation)
#The x-axis = Time (1500 scans/time points)

# Component 1: Default Mode Network (DMN)
# Meaning: Active during rest, deactivates during tasks
# Brain regions: Medial prefrontal cortex, posterior cingulate

# Component 2: Task-Positive Network
# Component 3: Visual Network (Low Activity)

# Component 4: Motor/Sensory Network
# Meaning: Motor or sensory cortex activity
# Brain regions: Motor cortex, somatosensory cortex

# Component 5: Auditory Network
# Meaning: Auditory processing (may decrease due to habituation)
# Brain regions: Superior temporal cortex

# Component 6: Noise/Artifact (High Frequency) (Remove this component in ana
# Component 7: Head Motion Artifact (Remove this component!)

# Component 8: Mixed Network
# Meaning: Could be cerebellar activity or mixed networks
# Brain regions: Cerebellum or overlapping networks

# Component 9: Ventral Attention Network
# Meaning: Attention-related network (ventral stream)
# Brain regions: Ventral attention regions

# Component 10: Noise/Physiological Artifact (Remove this component in analy
```

```
Downloading fMRI data...
[fetch_haxby] Dataset found in /Users/xinyang/nilearn_data/haxby2001
Haxby dataset loaded
Original shape: (40, 64, 64, 1452)
Smoothing and masking...
fMRI data shape: (1452, 25346)
  Time points: 1452
  Brain voxels: 25346

Standardizing data...
Applying ICA...
ICA Completed!
Components shape: (1452, 10)

Plotting components...
```
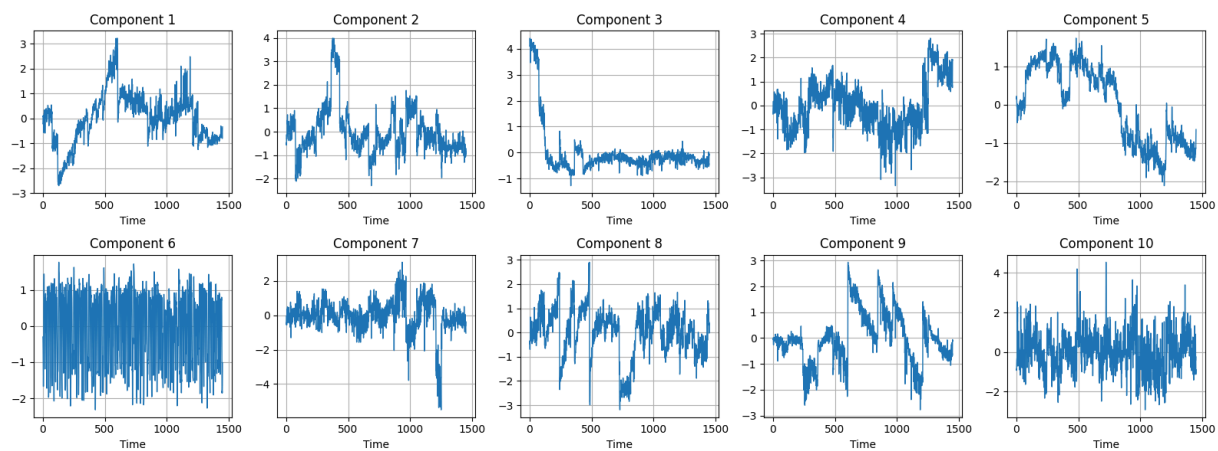
In [ ]: