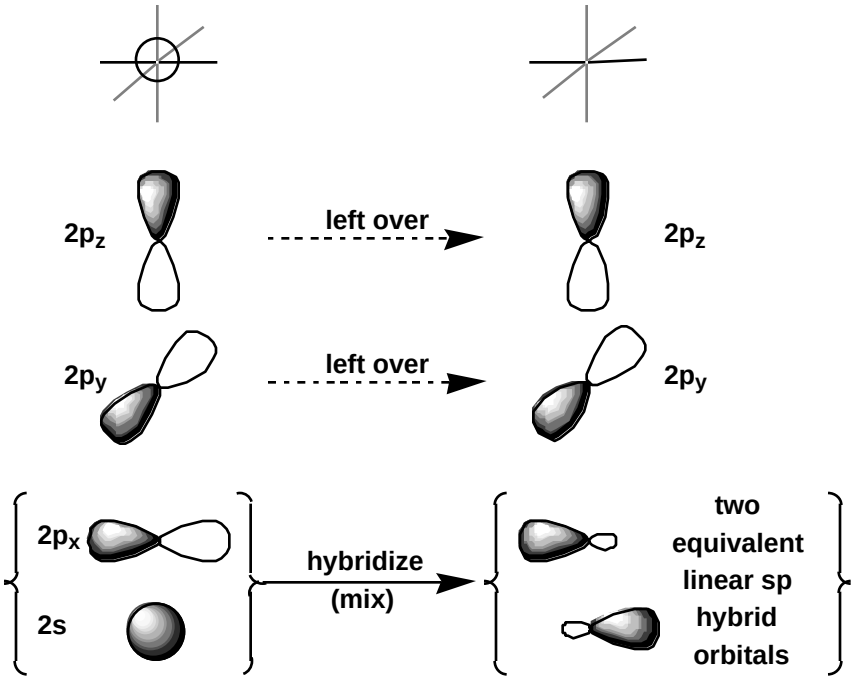
Text Related to Segment 7.05 ©2002 Claude E. Wintner

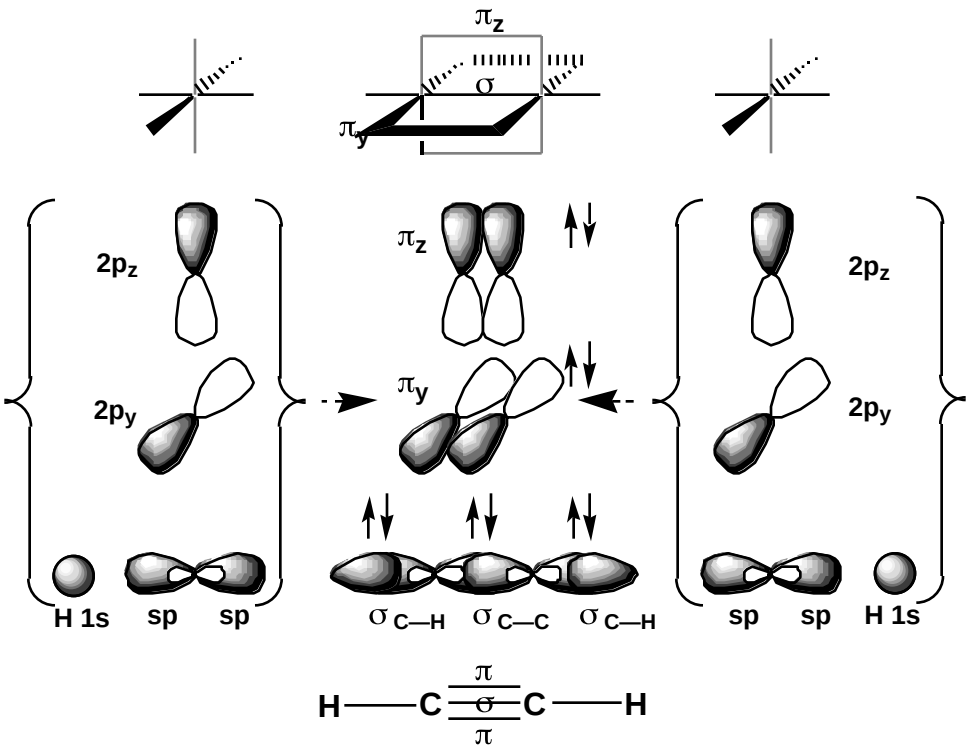
Carbon also is found in structures having a linear geometry, the prototype being the molecule ethyne, or as it still commonly is called, acetylene. Acetylene has the formula C_2H_2, with the atoms arranged as H—C—C—H. All four atoms lie along a linear axis. The C—C bond length in acetylene is considerably shorter than in ethylene (1.20Å vs. 1.34Å). To rationalize the bonding we mix the 2s and $2p_x$ orbitals of carbon to form two equivalent linear sp hybrid orbitals, leaving the $2p_y$ and $2p_z$ orbitals unchanged:



construction of sp hybrid atomic orbitals by mixing 2s and 2p orbitals

Again directionality is conserved, the linear sp orbital array reflecting the one-dimensional character of the starting p orbital. When two of these sp/sp/p/p orbital arrays from carbon are assembled with two 1s orbitals from hydrogen, the result is

overlap to form two C—H σ bonds and a C—C *triple* bond, composed of a σ bond and two orthogonal π bonds:



σ/π bonding scheme for acetylene